VOL. XIX] [No. 2.

THE

INDIAN FORESTER;

A MONTHLY MAGAZINE

OF

FORESTRY,

AGRICULTURE, SHIKAR & TRAVEL

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FEBRUARY 1893

MUSSOORIE:

PRINTED BY THE MAFASILITE PRINTING WORKS COMPANY, "LIMITED."

1893.

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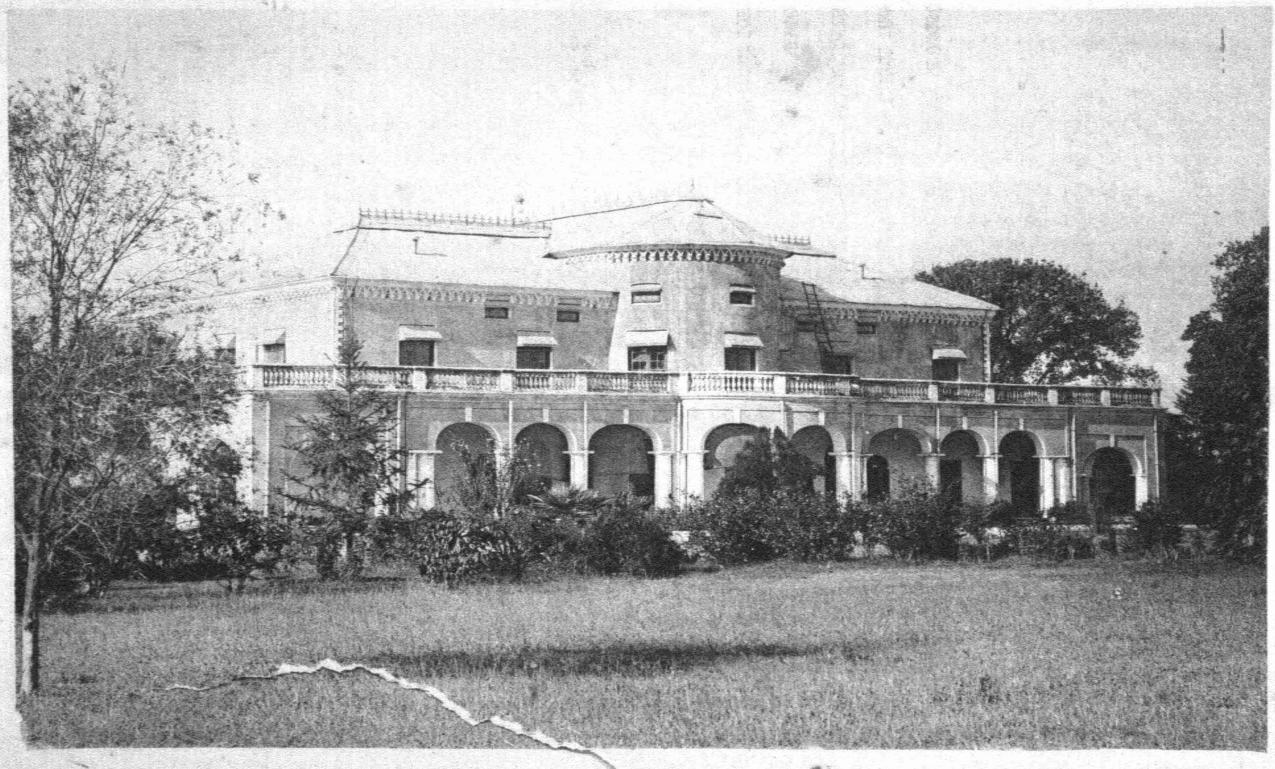

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Forest Administration in the Central Provinces.

In a recent article I endeavoured to explain the methods in force at the present moment for the management and administration of the Government Forests ; and the lines along which future legislation would, in all probability follow, judging by various Government Resolutions. It was there shewn that the present system consisted merely in the throwing open of whole forests to be exploited, throughout their length and breadth, at the will and pleasure of any purchaser of a licence, which licence entitled the holder to extract only the exact quantity of produce paid for, and lasted for the number of days required to extract the same.

Under the pending rules it was shewn, that, in addition to the above rules which would continue to remain in force, the intention would be, either to issue licenses to certain classes of people, which would entitle the holders to obtain from the forests all their personal requirements, in this line, for one year and for a fixed sum so calculated as to fall far below the actual existing value of the probable consumption of one family during that period ; or, to allow cultivators or agriculturists to obtain thorns for fencing, dead leaves, cow-dung, throughout the year *free of charge*, and to purchase the existing licenses for firewood, grass for thatching, wood for agricultural implements and bamboos at a rate *one third lower* than the ordinary district rate.

From the above it would appear that the only difference between the present and the proposed system lies, after all, in the fact that whereas at the present moment, a villager is compelled to obtain and pay for a separate license each time he wishes to extract produce from a forest ; under the proposed rules the cultivator would have free entry to the forests for certain produce, throughout the year, and would obtain the existing licenses for all other produce at greatly reduced rates.

Leaving out of consideration, consequently, all matters relating to the increasing difficulty of guarding the forests and of keeping any check on the produce removed, without a considerable increase in the present outdoor establishment, it would appear that the whole controversy between the existing and proposed systems would turn upon a question of lowering the rates, and increasing the freedom of the purchaser. It is well to say at once that even the most sanguine partisan of the present system would admit that it is "vicious in principle." This I attempted to explain in a previous article. But, it was there also stated that the proposed system would be a distinctly retrogressive step. It is necessary, therefore, to say a few words as to the probable evil effects of lowering the rates in a wholesale manner, for stress must be laid upon the fact that the Local Government has ruled that it will be absolutely necessary to abolish, once for all, the distinction between forest and forest in the same district, as regards the rates.

Now the existing rates are the outcome of many years of thought and consideration, change and trial. It must be acknowledged at once that these have been primarily fixed in reality upon merely commercial principles; and in accordance with the views expressed by Mr. Ribbentrop in his 'Note on the Forests of the Central Provinces,' *viz* :—" rates should vary with the distance of the forests from the market and with their accessibility. The rates must be lower for forests far removed, and higher for those in the immediate vicinity of the market." But far more lies hidden behind these apparently purely monetary or commercial laws. They have, in fact, constituted a perfect, though rough Working Plan, if such a term may be used ; and have in all cases been a check in regulating the working or rather the outturn from the forests. To explain this it is sufficient to say that just as the rates were fixed in accordance with the demands on the forests, so the demand—that is the outturn—could be regulated by the rates ; and, if the principle be correctly worked, it is possible to conceive that the rates could be so fixed that only the annual increment of the forests—or less than this—would alone be extracted. This is, in fact, exactly what has been done, in most cases, under the present system and with the present differential rates.

It will be seen, however, that whereas the present system is still imbued with those great evils, so fitly explained by a late Conservator, Colonel G. J. Vansomeren, in his Annual Report for the year 1890-91 (*a*) ; yet it had from a forestry point of view certain redeeming features, which it is now proposed to utterly disregard by a wholesale lowering of the rates. It is astonishing

(*a*). "Another great point to be aimed at is to begin measures for the gradual, but total, abolition of the system of selling wood and bamboos on licenses. No forests into which a purchaser can go armed with an axe and a license to fell trees and bamboos at his will can ever be said to be properly worked by us. The license system, however carefully worked out in detail, is vicious in principle."

to think that in a province boasting of a Forest Department, such proposals were ever drafted; though I must admit that one of the desired results would thereby be attained. Now the objects the Government have in view are the following :—

(1) The supply of plentiful and cheap grazing.
(2) The supply of cheap fuel.
(3) The supply of cheap wood or other material for agricultural purposes.

And to these I am compelled to add :—

(4) The formation of Government Ryotwari Villages.

That these objects would be attained at once by throwing open all the forests, (without making any distinction between forest and forest) to the extraction of produce at extremely low or nominal rates, no one will deny. Neither will it be denied that the same objects could be attained, even more successfully, by doing away with that apparently unnecessary institution, the Forest Department, and allowing *to the present generation* a free entry and enjoyment of the forests. *Apres nous le déluge.* It is not necessary to enter into a such question here : but before accepting so suicidal a policy, it would be well to see whether a solution on some kind of scientific principle could not be obtained.

In a previous article it was shewn that the forest area which falls to the sole charge of one single executive officer, unassisted by trained or competent assistants, is enormous. As an example, it is only necessary to mention the forest area of some of the larger districts :—

	Square miles.
Mandla, with a forest area of	3001
Raipur	1385
Hoshangabad	1919
Chanda	3486

It will be seen at once, therefore, that in framing any proposals for the working of the forests, and the attainment of the above-mentioned objects, a whole district or forest division cannot be taken as the unit. That is to say, that whatever proposals be drawn up, it will always be necessary that the inhabitants of one part of a district should be able to obtain all they require within a certain radius from their homes. And, through it would not be necessary to accept any such strict ruling as it was found necessary to adopt in the Thana Forests of the Bombay Presidency—namely "that the inhabitants of every village may be able to obtain from the annual coupes, material for tahal and firewood at a convenient distance from their village, which distance has been fixed as not more than four miles," (*Indian Forester* for March 1892)—yet, something on these lines would have to be introduced at least during the first rotation.

Now every district is divided, with reference to the Government Forests situated in that district, into Ranges. These Ranges are naturally primarily purely forest divisions ; but with very few exceptions, (*a*), which could either be rectified, or which would call for special treatment, the various parts of a district inhabited and under cultivation, would naturally look to one or other of these Ranges for their forest supplies. It is, therefore, only necessary to take a Range, and as a rule, the existing Range, as the unit for working purposes : and within this Range all the different requirements of an agriculturist, or of an ordinary resident of the district would have to be supplied.

These requirements have been defined above and for each Range the following considerations would arise :—

(1) The selection of culturable areas.
(2) The formation of grazing areas.
(3) The production of fuel.
(4) The production of wood for agricultural purposes.

The above to be supplied in sufficient quantities to meet primarily the requirements of the agriculturist. With reference to this matter, it need only here be mentioned, that many of the villages are in possession of the so-called Malguzari or "Communal" forests, which were given to the Malguzars and the villagers, and are still maintained with the object of supplying the residents of the villages with free "nistar" or forest produce for home consumption. From this it will be seen that, after all, the call on any one Range would at least, not at present, and not until the Malguzars had completely ruined their own forests, be of enormous extent ; except in those few Ranges in the adjoining properties in which no communal or Malguzari Forests exist.

It now only remains to consider roughly how the objects, enumerated above, may best be attained from a forestry point of view.

(1). The selection and excision of culturable areas.

In discussing this matter, the only point which must be borne in mind is that it is necessary, or at least advisable, to maintain a certain percentage of the area of a district under forests for the purpose of supplying forest produce to its inhabitants. Dr. Schlich in his "Manual of Forestry" has stated that for a nation, half an acre per head of inhabitants is a sufficient area to be kept under forest. But, as we have smaller units to deal with, and more especially, if we bear in mind the large extent of forest area at present under the management of the Forest Department, it would be as well to lay down a higher minimum, though the

(*a*) I leave out of consideration here those areas or ranges situated far from habitations as a rule, surrounded on all sides by other Government Forests. These will be treated of separately. They would, for the present, constitute the "High Forests."

physical features of the ground and its culturability would naturally largely affect this point ; as would also the extent of private Malguzari Forests.

The mere procedure of selecting the culturable areas would present no difficulties. Sufficient data could be supplied at once by the Divisional Officers and it would only be necessary to depute specially selected officers either from the Commission, or from the Forest Department to visit these areas, and demarcate and excise those suitable and required for the formation of ryotwari villages. As soon as this work was completed, the areas and boundaries of the Government Forests would be fixed once for all. The work is undoubtedly one of some importance ; but it is neither one which would entail great labour, nor occupy considerable time, owing to the present satisfactory upkeep of the existing boundary lines, though the interior of the forests may, in certain cases, be more or less cut up with patch cultivation and even villages.

(II). THE FORMATION OF GRAZING AREAS.

Here again no great difficulties should be experienced. The difficulty, on the contrary, would be to curtail the areas which would naturally fall under this head. In every district there are large and extensive tracts, covered with little else but grass. These would naturally fall under grazing areas for they could never be re-stocked unless a very large, and a very doubtful expenditure, were incurred for artificial reproduction. Besides these, there are inumerable tracts varying in degree from almost barren areas, devoid of tree vegetation, to areas fairly well stocked. A certain amount of discretion would eventually have to be exercised in classing these areas ; though the extent of the grazing and grass demands, and the extent of the forest area available for the pole and fuel forests, would practically determine for or against the inclusion of any particular area among the grazing class. Moreover, at the commencement, many of the areas could in a way form part of the grazing areas by being treated on a selection system combined with a system of areas, a certain part of the forest thus yearly remaining opened to grazing. We next come to consider :—

(III).—THE FORMATION OF FUEL AND (IV) POLE FORESTS.

It is as well to say at once that, as far as the forests of these Provinces are concerned, speaking generally, no particular type of forest can be said to prevail throughout a forest, and, moreover, every forest is abnormal as regards its composition. The result is that in each case the particular type of forest required would, so to speak, have to be made and this, as far as possible, during the first rotation. And the forest would be made in accordance with the sylvicultural system selected. Or, as our object is to produce fuel and poles, all that need be aimed at or necessary, would

be the conversion of the irregular forest into coppice—or coppice with standards, for by such a sylvicultural system all our requirements would be produced.* It is well known that this system of coppice is the most simple to introduce, and further that by the system of areas, the age gradation with their corresponding areas will be more quickly established. And though it may be true that, by this method, during the first rotation, uneven annual returns will be obtained ; and that when the abnormal state of a forest is due to the fact that (*a*) the normal age gradations with their corresponding areas, (*b*) the normal growing stock, and (*c*) the normal increment, are missing, that the normal increment should be first established ; yet, with our present knowledge, and with the present staff, all that could be expected would be to introduce a system of areas, the size of the areas of each annual coupe being, as far as possible, on the inverse ratio of the quality of the soil, and, perhaps, of the stocking ; though with regard to the latter, as the several working sections would be abnormal, they could assist each other in order to obtain a full yield.

These, however, are purely technical questions which the Working Plans Officers would naturally solve, and could present no insurmountable difficulties. All we wish to attempt, at the present moment, is to show that the objects the Local Government have at heart can be solved by the principles of forestry, and simply by the formation of

(*a*). Grazing areas.
(*b*). Fuel and pole, or Coppice Forests.

Naturally, the above is merely an outline of the course which might be adopted in attempting to legislate for the working of the forests. We cannot here attempt to enter into details. Besides the matters above referred to, however, other types of forests and systems of working would necessarily present themselves—a few of which we may here mention.

Thus in the case of the teak-bearing tracts, the constitution of these into pole or high forest to be worked on a selection system would naturally suggest itself. The type of forest known as " Mixed " or " High mixed forests " would suggest a selection system, combined with a system of areas so that grazing might be yearly permitted over a proportion of the total area. And so on. Lastly it would appear necessary to say a few words with reference to the more inaccessible forests, meaning by this, those which are

*I would point out here that in each district, if not in each range, there exist certain areas, more or less extensive, which owing to their present composition would naturally be first selected as coppice forests. In fact, if any type of forest is at all worked—leaving out of consideration the real teak-bearing areas—it is these more or less dense or irregular coppice or scrub jungles. All that we could expect to do would be to work these coppice with standard forests on a rough system of areas, taking a fairly low rotation, leaving a large percentage of standards, at least during the first rotation, or what would more correctly be called preparatory period.

further removed from cultivation, and on which, consequently, there is little or no immediate local demand. There can be no doubt that these, especially as they are at the present moment, as a rule, stocked with fairly large timber trees, should be maintained as such and constituted into High Forests. The present policy tends to insist on the fact that nothing but "poles and small building wood, fuel, light fencing material as thorns, and brushwood for stack floors" should be produced. This is all very well as far as it goes, but may be carried too far, especially if too rigidly adhered to. It may be true that "*the people at large want very little large timber, and the increasing use by Railways of metal sleepers renders the chances of selling wood of large scantling smaller than ever,*" but it is more than probable that a certain quantity of large timber is required and will be required in the future, and unless Government continues to see to its production, it will not be available when required, as private owners and Malguzars cannot be expected to lay out the necessary capital, or put off the realization of an early return from their forests—more especially when it is considered how improvident the Malguzars of these Provinces usually are and how little store they lay even on the mere maintenance of their forests.

This being the case, whenever a forest is removed from cultivation, and from immediate local demands, and as long as it will lend itself to its formation into a High Forest—this system should be adopted.

A few more words in conclusion. As far as their forest administration is concerned, the present Local Government appear to be possessed with the very praiseworthy desire of seeking to provide for the welfare and well being of the agriculturists, by supplying at cheap rates, all their forest requirements. Sufficient has been said to show us that it is not by the maintenance of the existing systems and by a wholesale lowering of the existing rates, that these objects will be permanently attained. A solution can only be found in the introduction of Working Plans. Once these are introduced, it matters little from a purely forestry point of view, whether the produce to be removed yearly, the annual increment, be given away free, or be sold at low, moderate or even high rates.

As already remarked, it would appear that the Local Government aims at a higher ideal than that of merely raising as high a forest nett revenue as possible by any means, fair or foul, that may suggest themselves. This being the case, the present moment would appear most propitious for the introduction of a systematic system of working the forests. Let not the attainment of a high nett revenue be made so much the object of the Department, and the criterion by which its work is judged and its existence justified. Rather let it be insisted upon that scientific working of the forests should be introduced without further delay whenever expedient or possible. This should be the true aim of a Forest

Department. The present nett revenue might well be even wholly discarded, if by this means a sound system of working the forests be introduced and established ; the agriculturist be provided in abundance and at cheap rates with the produce he requires and to which he would appear to be entitled ; and some trustworthy data relating to the growth of the different trees, and other sylvicultural matters be obtained. (*Vide* page 10, para 35, of the Progress Report of the Northern Circle, Central Provinces, for the year 1890-91). In praise of the Department, it may be said, that all, or almost all, that can be attained by the existing indigenous systems, namely—a very high revenue ; a small expenditure ; in almost all forests a wonderfully improved and in many cases a good growing stock ; all these have been attained. But during the last few years the Department appears to have been sleeping on its laurels, only striving to increase its revenue. It is now time to make a fresh start. Working Plans, rest houses and accommodation for the office and out-door establishment, roads and paths, the collection of information relating to the forests and their constitution, a large and very needed increase in the out-door establishment—all these, and many more equally important matters must be taken in hand and started.

But—and it is a very big *but*—all this naturally means expenditure, and at first, a fall on the gross revenue ; and few, if any, wish to take this leap into the dark—though he may be sure of light and brightness ahead. The initiation therefore appears to rest with those in higher authority.

TUSCAN.

NEW ARRANGEMENTS FOR

Practical Work for the Coopers Hill students.

We have recently received copies of Dr. Schlich's and Sir D. Brandis's proposals regarding the arrangement of studies of the Forest Students at Coopers Hill, with a view to lengthening the time devoted to practical work in the forests of the Continent, now that the Forestry Course has been extended to three years.

Sir D. Brandis suggested two projects, together with an estimate of the probable cost of each, (*a*) that students should undergo five months apprenticeship under a German Forest Officer or (*b*) four and a half months apprenticeship under a German Forest Officer, followed by forty days touring with himself.

As these two schemes provide for different periods of time, Dr. Schlich has added a third modification, namely, (*c*) three and a half months' apprenticeship under a German Forest Officer, followed by 40 days touring with Sir D. Brandis. Scheme (*c*) is thus an alternative for scheme (*a*), supposing the practical training on the Continent to be restricted to five months.

Either of these schemes entails a considerable increase in the cost of the training scheme, (*c*) being the more expensive of the two.

Sir D. Brandis prefers that the practical work should be done in the fourth half year rather than at the end of the course. Should this course be decided on, Dr. Schlich recommends the adoption of scheme (*a*), whereas, were the practical work done at the end of the course, he considers scheme (*c*) preferable, as the students would then be better able to appreciate the varying conditions and methods of treatment found in a variety of districts. In the event of the former method being adopted, Dr. Schlich makes an addition by proposing that three or four of the best men of each year who have evinced a genuine interest in their profession, should be permitted to visit a few specially interesting districts of the Continent, so as to enlarge their views on their way to join their appointments in India. The proposals then stand as follows :—

(1). The students to remain at the College for the first eighteen months to study auxiliary sciences, the principles of sylviculture, and forest mensuration, accompanied by work in the forest nursery, visits to neighbouring woods, Cæsar's Camp school forest, and some specially selected forests in Normandy.

(2). Practical work in Germany from about the 1st April in the second year of the course, until the beginning of September of the same year, the students to be placed two and two under selected Prussian Oberförsters.

(3). The students to remain at the College throughout the third year of the course to complete the study of forestry in the class room and in Cæsar's Camp school forests, including the preparation of a complete Working Plan.

(4). Some of the most promising students to be deputed to visit a few specially interesting forest districts on their way to India, such students to be selected by the President of the College in consultation with the Principal Professor of Forestry.

Should these proposals be sanctioned, as we understand that they have been, the first batch of students who would go to Germany are those who joined the College in September 1891, the men who joined in September 1890 being dealt with on the old lines.

Notes on the State Forest of Lyons (Normandy).

(Prepared by Monsieur Le Père, Inspecteur des Forêts, Lyons. Translated into English by Mr. W. R. Fisher, Assistant Professor of Forestry, Coopers Hill College.)

Area and locality.—The State forest of Lyons contains an area of 26,211 acres.

It is situated 20 miles from Rouen, in the two Departments of the Eure and the Lower Seine, and extends over a tract of country bordered as follows :—North, by the plain of Argueil ; east, by the valley of Epte ; south, by the plains of Norman Vexin ; south-west, west, and north-west, the valleys of Fouillebrocque, of the Lieure, and of Andelle.

This tract, owing to its configuration, as well as to the varieties of its soil, affords characteristic examples of the various aspects of Normandy with its forests, meadows, and arable lands.

The Department boundary line divides the forest into two nearly equal portions—in the north, the blocks of Fleury and Gourvinay, with an area of about 11,293 acres ; and in the south, the blocks of Fleury sur Andelle, Lyons, and Etrépagny, with an area of 14,918 acres.

A polygon surrounding the forest would be no less than 42 miles in perimeter, its greatest breadth from east to west, as well as from north to south, being about 14 miles.

The forest is demarcated by boundary pillars along a total length of 203 miles. The little town of Lyons is situated in the valley of the Lieure, in a nearly central position as regards the forest, which descends to the banks of the Andelle in the south-west from the elevated plateau of Beauvoir in the north-east. The altitude of the forest above sea level varies from 164 to 722 feet.

More than half the forest is situated on undulating ground, and it is almost cut in half from north-east to south-west by the fairly deep valley of the Lieure and the depressions leading into it. The depressions of Fouillebrocque and of St. Catherine's springs subdivide it in the south, parallel to the valley of the Lieure.

The River Lieure, which springs up in the forest at Holly fountain, bounds its eastern blocks to the south in a pretty deep valley, into which several depressions, coming down from the forest, lead.

Climate.—The forest of Lyons almost everywhere shows a remarkable vigour of growth due to the mild and moist climate of a region not far removed from the sea.

Soil.—The soil is formed by the weathering of secondary and tertiary geological strata ; the former is only exposed in the lower part of the valleys, and belongs to the upper cretaceous formation, consisting of nearly horizontal beds of white chalk, with numerous layers of flints. The tertiary strata are much less regular and form

the subsoil over the greater portion of the forest area. They contain many different mineralogical elements—flints, gravel, quartz, sand, sandstone, dry sandy marls, plastic clay containing iron, &c. The latter is found in the depressions of the silicious strata, consisting of sand, sandstone, and rolled flints. Such a deposit occurs between Lyons and Gisors. The strata near Hogues are remarkable for a mass of ochraceous sand, puddingstone, and massive sandstone. Everywhere on the surface of the Lyons block, sandstone and flints abound. Near Mont-Roti, the strata contain bright variegated quartz. From several places sand, clay, and sandstone are exported, and almost everywhere the flints are utilized for road metalling.

The soil formed from very variable proportions of the débris of those different elements varies considerably over small areas, sometimes attaining a depth of 13 feet, at others being reduced to a superficial coating of hardly eight inches.

The amount of moisture in the soil varies according to its composition and gradient, the soil being generally moist and permeable. Marshy ground only occurs in patches, 7·4 acres at Hotel-à-Dieu, and has almost disappeared owing to drainage works executed about 15 years ago; but ponds are not uncommon, and have served in the nomenclature of several compartments. One of them has given its name to the celebrated abbey of Mortemer, the picturesque ruins of which still exist. These ponds appear to have been excavated near old dwellings, traces of which are still visible.

About one fifth of the forest area may be classed with neighbouring first-class arable lands, one fifth as second class, two fifths as third class, and the remaining one fifth as fourth class. The estimated value of the forest land formerly placed at 16*l.* to 40*l.* per acre, would now be too high.

Species.—The forest of Lyons is pre-eminently a beech forest. This species occupies more than two-thirds of the area; it attains here very fine dimensions at a comparatively low age. One frequently sees beeches only 100 to 120 years old with a height of 131 feet and a diameter of 20 to 28 inches, measured at 3·3 inches from the ground.

The wood of Castelier, 150 to 230 years old, contains more than 14,291 cubic feet per acre, the trees there having a mean height of 148 feet (*vide* Appendix).

The hornbeam and the oak are mixed unequally with the beech, the proportion of the oak being less than one fifth of the stock. The wild cherry, ash, birch, aspen, and sallow only appear occasionally, the two latter merely in the young thickets, before cleanings have been made.

A few small woods of Scotch pine may also be noted, situated on soils at present too poor for broad-leaved species.

The sycamore and elm have been introduced into some old blanks.

Nature of the stock, its age, and density of growth.—Most of the forest is composed of woods with a proper succession of ages

up to 120 years. Some few woods are 150 to 160 years old. Nearly everywhere in the regeneration fellings the presence of a certain number of old standards compensates for the relatively low age of the rest of the crop. On the whole, middle-aged trees somewhat preponderate.

Few other forests in France are so completely stocked. Blanks are almost entirely unknown, and plantations are only required to complete the natural regeneration, at the extremely rare places where it is delayed beyond the usual time. These plantations are generally made to introduce oak into pure beech woods.

From time immemorial, the forest of Lyons has been treated according to the regular high forest system, and it is due to this treatment that its woods are so exceptionally well stocked.

Working Plan of the Forest.

Method of working.—The forest of Lyons is treated as high forest by the shelter-wood compartment system (*Méthode de réensemencement naturel et des éclaircies*),

The working plan sanctioned in 1862, but actually applied since 1856, divides the forest into 15 working sections (*séries*), with a rotation of 150 years for each, which is subdivided into six periods of 25 years each for working sections 1 to 12 and 14. The area to be worked in each period is termed a periodic block.

At the end of the first period, 1881, the revision of the working plan was carried out for these 13 sections, the annual yield of the principal fellings being calculated for the second period. The allocation of the improvement fellings (thinnings and cleanings) was at the same time fixed for the second period, each compartment to be gone over twice during the period.

In the 13th and 15th working sections the rotation was subdivided into five periods of 30 years each, and the first period expired in 1885. The revision of the working plan for these sections took place in 1886, and the allocation of the improvement fellings made; they will go over the ground three times during each period of 30 years. The forest, therefore, for 13 working circles is in the eleventh year of the second period, and for the two others in the seventh year of the second period (in 1892).

Principal fellings.—Three regeneration fellings (seeding, secondary, and final fellings) are carried out, as, although natural regeneration is certain, it is not rapid enough for the seed-bearers to be removed in one felling, and they are also useful in affording protection to the young crop.

At present, in the middle of the second period, seeding fellings are most frequent.

Secondary fellings have, nevertheless, been made in some of the working sections, in the first seeding fellings of the second periodic blocks. Certain portions of these fellings, where the regeneration has been very favourable, are already partially under the final felling.

Improvement fellings.—The improvement fellings are regulated by area. These fellings, during each period, go over all the periodic blocks which are not under regeneration; that is to say, for the second period, the 1st, 3rd, 4th, 5th, and 6th periodic blocks, except in the 13th and 15th sections, which have only five periodic blocks.

Accordingly, as these fellings must recur twice or thrice in each period, the total area is divided by one half or by one third the number of years in the period, and thus the area of the annual improvement fellings is calculated.

The subdivision of the periodic blocks into areas for each annual thinning has been marked out on the ground, thus perpetuating the regular course of these fellings.

In the young woods of the first periodic blocks, the improvement fellings are at present cleanings (removal of soft woods and setting free valuable species); in the other periodic blocks they are ordinary thinnings, that is removal of suppressed, defective, or dying trees, setting free oaks, and sometimes in the 5th or 6th periodic blocks, felling certain old trees which cannot be expected to live until the 5th or 6th periods, and so well surrounded by the younger growth that there is no danger of the crop being over thinned.

Yield; Nature of Forest Produce and Market for it.

Yield.—The annual yield of the forest of Lyons is more than 988,837 c. feet of principal produce (from regeneration fellings calculated by volume), and of nearly 1,977 acres of improvement fellings, yielding more than 30,000 stères and 200,000 faggots, representing 847,575 c. feet or a total annual yield for the forest of 1,836,412 c. feet, about 71 c. feet per acre.

This figure does not exceed the annual increment, and may be increased when a regular gradation of ages has been everywhere established throughout the forest.

The figure of 5,716 c. feet per acre, representing the actual mean volume of the mature standing crop now being regenerated, and of which the average age hardly exceeds 100 years, and which has already furnished a nearly equal volume under the head of thinnings, proves the correctness of this estimate.

Marketable produce.—The oak (sessile and pedunculate), the beech, hornbeam, wild cherry, birch, ash, and maple, are the chief marketable species of the forest of Lyons. We merely mention the aspen, sallow, and scotch pine, which up to the present time have only yielded produce in the cleanings, all faggots, except a few pine poles.

Oak.—Oak of good quality is exported from the forest in logs, or planks. Second-class trees are sawn up into railway sleepers, beams, or split into staves, park palings, wheel spokes, &c. The crowns of large trees and all small oak wood are sold for fuel.

Oak trees of moderate size are not much in demand. The price of oak railway sleepers has gone down almost to the same figure as for beech. Beams for use in construction, find few purchasers. This is due to the competition of iron girders, and of imported wood. Hardly any oak bark is sold in the forest of Lyons.

Beech.—The demands for beech have varied considerably during the last few years.

After having experienced a depression of nearly 6 per cent. from 1880 to 1886, owing to the cessation of the trade in railway sleepers, and to the diminution of that of sabots, beech has recently somewhat recovered in price; railway sleepers are regularly sold from the fellings, certainly at rather a low price, but still this assures a sale for beechwood of large dimensions, and secures a better price for firewood.

The sabot industry also absorbs a number of middling-sized beech trees; the finest wood is, however, exported in logs for the Parisian sawmills, or those of the neighbourhood, where they are converted into planks for furniture, or into coopers' wood.

A large proportion of the beech wood is used for fuel in the neighbourhood of the forest, or at Rouen and Elbeuf, some firewood from the centre parts of the forest going to Paris.

Hornbeam.—The finest pieces of hornbeam are used for the sabot and other industries; most of this wood, however, is used for fuel in the same localities as beech wood.

Wild Cherry.—The wild cherry is greatly in demand for the saw-mills for chair making. Some fine trees of this species are found in the forest.

Ash.—Ash is only found of a limited size and is therefore only used for certain homely purposes, poles, &c. Very little wood of this species is large enough for wheelwrights' work, but there will be a fair supply when certain woods come under the axe.

Birch.—The same remarks apply here as for the ash. A few trees become large enough for sabot making, but the wood is generally used for fuel. This is also the case as regards the field maple, its dimensions being inadequate for other employment.

The sycamore and the elm are only found in plantations and have not yet come into use.

The other inferior species are only made into faggots coming from the cleanings, or in charcoal wood.

Scotch pine.—The Scotch pine is restricted to 148 acres in the forest of Lyons, and has hitherto only been felled in cleanings or thinnings, and furnishes posts for fences, and firewood.

Trade in firewood.—Firewood in the forest of Lyons is sold as split wood of different lengths, and as round wood 2ft. 2in. long, and as wood for charcoal. This last product is only of limited importance and its preparation only increases when the price of firewood is particularly low. Charcoal is then made, in order to reduce the transport and secure a rapid clearance of the fellings. Not more than one-tenth of the firewood is so employed.

Carbonisation is effected at Lyons, and in the forest in very small kilns of from 283 to 706 stacked c. feet.

The demand for faggots varies considerably, but on account of their relatively small number and the minute subdivision of the forest, a number of ready purchasers are secured.

Price of material.—The price of wood in the forest of Lyons has not only followed the general fall in prices which has prevailed during the last few years, on account of the competition of iron and imported timber, but this has been aggravated locally by the difficulty and the high price of labour.

The fact that firewood at Lyons is only worth three-fifths of its price at Rouen 24 miles distant, shows how important it is to improve the means of transport.

The average price of the cubic metre of standing timber, inclusive of stem, top, and branches, has been, during the last ten years 2½*d.* a cubic foot for the principal fellings, and 1⅔*d.* a cubic foot for the thinnings. This gives a mean annual revenue of 15,840*l.* or 12*s.* 6*d.* an acre, for the whole forest; or of 13*s.* 4*d.* per acre if we include the value of the minor produce.

This figure is very inferior to the normal revenue; it exceeded 1*l.* 3*s.* 4*d.* per acre in 1830, and it is to be hoped that it will soon go up at least to 16*s.* 8*d.* per acre, when the present commercial crisis has terminated.

Minor produce.—Independently of the saleable wood, and of the dead wood given away to the neighbouring poor people, the forest of Lyons yields certain accessory produce, the value of which is realised either in cash or in daily labour.

First of all in the former category comes the game, which produces 880*l.* a year.

The total yield in money of the other minor produce, quarries, removal of clay, sand, ferns, plants, &c, is not of much importance, about 160*l.* The numerous quarries opened out in the forest cause a much greater loss than their receipts but their concession is necessary in the public interest.

Concessions of standing dead wood, of ferns, or heather, are repaid by daily labour at the rate of 70·6 stacked c. feet or 50 bundles for each day. The same may be said of pannage, one day for each pig during a season of six months. These days form a precious resource for the maintenance of roads, and the execution of urgent and unforeseen works.

Detailed Account of the Method of selecting Trees to be felled.

Seeding fellings.—In a normal wood of the dense growth found at Lyons, the trees reserved at a seeding felling are in number about one third of the standing crop, but only one half in volume,

as the finest middle-aged trees are selected as seed-bearers. The oldest beech are generally felled, as middle-aged trees are more fertile, and yield seed of a better quality.

Preference is always given to oak, already so scarce in the forest, and care is taken to concentrate the seed-bearers of this species, as its light shade requires concentration to protect the seedlings from frost and drought. The extraction of the stumps of most of the felled trees is a good preparation for natural regeneration, which is also facilitated wherever necessary by the use of the Bienvenu forest plough.

This plough, idvented by M. Bienvenu, at present Honorary Sub-Inspector of Forests, is constructed like a cultivator with three teeth, each placed on a spring strong enough not to yield in ordinary work, but only when it meets with an obstacle such as a root or large stone. A double lever also affords means of regulating at will the depth of the work, and of raising the whole apparatus so as to avoid obstacles, or portions of ground already stocked, which are not to be ploughed up.

The instrument is worked by one man and two horses, but on ground very weedy, or covered with brambles, two men are required, one to drive the plough, and the other to free the instrument from weeds from time to time. The best and most economical results have been obtained by the use of this instrument, which works fast and well. Hoeing is only employed in places where the soil is too stony or too steep, or in out-of-the-way places too small to repay the cost of transport of the plough. Owing to the necessity for working a great number of places in the forest, the operation is carried on both before and after the fall of the mast. The work done is useful in both cases; if before the fall of the mast, the latter gets on to loose soil and is covered by the dead leaves; if after it, a large quantity of mast is buried in the ground. The latter method is preferable in woods most frequented by red deer, especially by hinds. The plough costs 16*l.*

Secondary and final fellings.—The location of the fellings depends on the condition of the young crops and the limit fixed for the annual yield. In every working section, therefore, fellings considered necessary on account of the state of the young growth are always made before commencing to regenerate a new area by a seeding felling.

In the forest of Lyons, where the beech predominates, the work is facilitated by the faculty which this species possesses for supporting prolonged shade. As the oak differs in this respect, great care is taken to set free its seedlings as soon as this becomes necessary.

The course of regeneration being naturally irregular, the secondary and final fellings are frequently amalgamated into one, which is called a secondary felling in some cases and a final felling in others.

The secondary fellings generally follow six to eight years after the seeding fellings, and are themselves pretty quickly followed by the final fellings. The regeneration is therefore completed in from ten to fifteen years at the outside.

Compartments where the oak predominates form exceptions to this rule, and if the seeding may have to be awaited as long as for the beech, it is completed more rapidly, but unfortunately is more difficult to secure.

Thinnings.—Most of the thinnings are sold standing by *unit of produce* which method is profitable financially and sylviculturally. The trees to be felled are marked either with the forest guard's hammer or with the marker; the merchant then fells and converts them, the produce being afterwards measured and its price regulated at the rate agreed upon at the auction.

By this method, the forest officials can, at any time, during the felling, increase or correct the markings. The necessity for carefully preserving the oak in the Lyons forest renders this method peculiarly valuable.

As thinnings are made by area, marking for them merely follows sylvicultural rules. Generally they are limited to the removal of dying and suppressed trees; under the light cover of the oaks, even hornbeam of little promise is left, being useful in keeping up the density of the leaf cannopy. The operation follows nature, rarely forestalls it. The forester is guided also by the state of the crop and quality of the soil, marking lightly on poor soil and warm aspects, but more boldly wherever a vigorous growth allows him to reduce the number of stems without endangering the density of the woods.

While strictly respecting these rules, the compact condition of the woods renders the produce of the thinnings very large: the last thinnings executed produced more than 714 c. feet and 120 faggots per acre. Some woods actually yield 1,143 stacked cubic feet per acre.

Cleanings.—The cleanings are made at the expense of the State, and for them a special credit is afforded, whilst the produce is sold and the price credited to the State. These operations have for their object not only to thin out the over-dense thickets of young wood, but also and chiefly to protect valuable species, and especially oaks. With this object in view, one need have no hesitation in removing or pruning a beech, hornbeam, or other species which is threatening young oak saplings.

The sale of the produce of a cleaning frequently scarcely covers its cost, but their future usefulness gives them great importance. No markings can be made in these fellings on account of the great number and small size of the stems, and the work can only be entrusted to skilled workmen constantly supervised and directed by the guards and forest officers.

APPENDIX.

Note on Compartment E^2, Canton du Castelier, in the 12th working section. (Area 67·88 acres.)

This compartment contains 4,660 trees (173 oaks, 4,244 beech, 243 hornbeam), or 69 trees per acre. The trees have an average age of 160 years, with some old standards 180—240 years old. The average volume is 14,291 c. feet per acre.

Some sample areas chosen in the best part of the wood, show :—

1. For the area containing the trees largest in diameter, 48 trees per acre cubing 15,578 c. feet per acre, an average of 345 c. feet per tree.
2. For the part of the area where the trees are tallest, 81 trees, and 15,006 c. feet per acre, 185 c. feet for the average tree.

Taking the wood as a whole, the mean height of all the trees is nearly 184 feet, some trees even attaining 164 feet. The diameters at 3·3 feet from the ground vary from 14 in. to 43 in. and the law of diminution of these diameters (the rate at which the trees taper with elevation above the ground) varies between 1 per cent. for trees below 4·9 feet 3·3 feet from the ground, and at the most 2 per cent. for the tallest trees. The total surface of the horizontal sections of the stems measured at 3·3 feet from the ground is $\frac{1}{217}$ ths of the total area of the compartment.

COOPERS HILL.
6th July 1892.

Insects injurious to Coniferæ.

The following extracts from a valuable paper by Mr. W. F. H. Blandford, M. A., F. Z. S., &c.. published in the Journal of the Royal Horticultural Society, will be of interest to our readers.

"Of all families of trees, the Coniferæ suffer most severely 'from the attacks of insects, owing to the large number of species 'which they support, and to the difficulty which, on account of their 'physiological characteristics, they have in withstanding injury.

'The wide area over which forests of these trees extend 'increases the danger of insect-attacks, in accordance with a well-'known law which holds with injurious insects ; and it is among 'Coniferæ alone among trees, and among the forest-species of 'Pine, Fir, and Larch—for the Yews, Cypresses, Thuyas, &c, do

'not now concern us—that have happened those repeated instances 'of widespread destruction over large forest areas which, occurring 'even before economic forestry began to change the character of 'the primitive mixed woods, probably increased in number and 'severity at that epoch, and have continued at intervals to the pre-'sent day.

'A striking example of this destruction is that which happened 'in the period 1853-68, in East Prussia, Poland, and Russia, 'when the Spruce was killed over an area of 7,000 square 'German miles. A similar instance is that afforded last year in 'the Bavarian forests by the plague of the same destructive in-'sect (*Liparis monacha*); the loss caused by this to the revenue 'was estimated at £40,000.

'The immense importance of these attacks has given an im-'petus to the study of forest-insects on the Continent, and a not 'inconsiderable mass of literature has sprung up. In this the 'foremost place must be given to the works of Ratzeburg, who 'was the first to place this branch of entomology on a truly scien-'tific basis.

'In the large number of insects feeding on these trees, only a 'few are of habitual importance, but exceptional abundance of a 'normally unimportant species, will bring about unexpected damage. 'This sometimes occurs in Great Britain, and I have heard com-'plaints of damage which was not assignable to any of the regular 'destroyers, but which could not be identified in the absence of 'specimens.

'Now the standpoint of the systematic entomologist or of the 'collector, is not the same as that of the economist, and papers 'written by the one will not always serve for the enlightenment of 'the other. The former is apt to neglect certain small points bear-'ing on the habits of the insect which do not immediately concern 'him, and especially those connected with the appearance, vitality, 'and aftergrowth of the plant on which his prey lives; while the 'economist, more particularly the practical forester, who thinks 'more of the injured plants than of the destroyer, has occasionally 'a royal disregard of the sordid details of specific characters, which 'brings him into trouble when he discovers that closely allied 'species often have remarkably different life-histories. In writing 'the account of any new injurious insect, it is essential that an '*exact* determination of the species shall be made, and the life-'history constructed as completely as possible from personal ob-'servation, especially with regard to times of appearance, or if 'already recorded, it should be verified by observed facts.

'The special liability of some Coniferæ (*Pinus*, *Picea*, *Abies*, '*Larix*) to injury by insects, and the important character of such 'injury, are due to the following facts.

'1. There is a very large number of insects which attack 'them. Kaltenbach enumerates 299 on the forest conifers in 'Europe. This number falls, indeed, far short of the 537 assigned to

'the Oak, but neither list can be taken as strictly accurate. Many 'species are omitted, especially from the former list, while in the 'case of the Oak the number appears to be swelled by the dragging 'in of species having little real connection with that tree.

'In Ratzeburg's "*Forest-Insekten*" 95 species are tabulated 'as injuring Coniferæ, while only 36 are referred to the Oak; but 'subsequent researches would increase both these figures.

'2. Every part of the tree is liable to energetic attacks from 'one insect or another—the roots, the bark of the trunk and bran-'ches, the wood, needles, shoots, and lastly the cones, the seed-'production of which may be greatly lessened by insects feeding 'in their interior.

'3. A common form of injury, especially on the Continent, 'is defoliation. Now complete defoliation of a Conifer, other than 'the Larch, usually means the death of the tree, because of the 'slowness with which the injury is repaired.

'If an Oak is stripped by *Tortrix viridana*—an annual occur-'rence in many English woods—or a Hawthorn by *Hyponomeuta* '*padella*, as in our London parks and gardens, the tree generally 'grows a new crop of leaves late in the year, provided that the 'defoliation is sufficiently complete and sufficiently early; but if a 'Spruce or Pine be stripped and survive, not only are no further 'needles produced the same year, but next year's growth may be 'delayed a month, and the new needles are stunted and form the 'curious bristle-needles figured by Ratzeburg. The tree will take 'four or five years to recover its normal covering of needles, and 'with them its normal process of growth; so that during that period 'the total increment will only equal, or may even be less than, that 'of a single ordinary season.

'4. Defoliation renders a tree liable to the attacks of other 'insects, especially of the much-dreaded bark-beetles, which have 'so often completed the havoc begun in European forests by hordes 'of caterpillars. I do not intend to discuss here all the various 'aspects of the perennial and much-vexed question as to the econo-'mic importance of these and other wood-feeding insects and the 'susceptibility of perfectly healthy trees to their attacks, but refer-'ence to it cannot be entirely omitted.

'It may be true that bark-beetles and longicorns never 'attack a tree in perfect health; that is the opinion of many ento-'mologists, whose number by no means includes all those whose 'familiarity with forestry compels them to keep sight of the prac-'tical side of the question—men like Eichhoff, the leading author-'ity on these beetles and the head of a large forest-district, Judeich 'and Nitsche, &c. Yet a disease would not be considered unim-'portant by the physician because it rarely or never attacked the 'robust; if it occurred as the sequela of other complaints, killing 'patients whose recovery would have been certain, it would de-'mand serious attention. So these beetles, as the health of every

'tree in a forest cannot be assured, still possess importance even if 'their attacks are limited to the sickly plant.

'But though no one doubts that they, in common with all 'insects, prefer an unhealthy plant to a healthy one, they may not 'always reject the latter. Here in Great Britain there is great 'difficulty in arriving at a just conclusion, for many injurious 'species are unknown or are exceedingly rare, and it is dangerous 'to argue about the habits of any one kind from analogy with those 'of another. Though a species breeding in small numbers in a 'wood with plenty of brood-material may let alone timber which it 'would attack if it were present from any cause in immense 'swarms impelled by the necessity of egg-laying and with lack of 'suitable breeding-places, there is yet evidence that these insects, 'if dying or injured wood is not at hand, attack sound trees for 'egg-laying, and if the assault does not succeed, the large number 'of attempted burrows serve to weaken the tree, which may 'succumb after several repetitions. When it is recollected that a 'square mètre of bark has been known to contain nearly five 'thousand larvæ of *Tomicus typographus*, it will be seem that a 'large quantity of suitable breeding-material may cause an increase 'in the numbers of these insects that will jeopardise the healthy 'trees. A particular form of injury inflicted by some of these 'beetles is that of attacking and breeding in the crown and upper 'branches of old trees whose vitality is not great. This attack, 'which spreads down the branches till the main trunk is involved, 'has been described on certain deciduous trees, and is of importance 'as likely to be overlooked.

'Damage by storm, snowfall, frost, or by forest fires, or cater-'pillar-defoliation, together with careless forestry and the slovenly 'accumulation of loppings, felled timber, and unbarked logs, serve 'to foster the development of such insects, till serious injury is 'risked. The thin-barked Spruce suffers more than the Pine, and 'it was the forests of this tree that were so terribly ravaged by 'bark-beetles in the Harz Mountains during the last century.

'That bark-beetles have been associated with destruction of 'trees over immense areas is undoubted; and it lies with the advo-'cates of the theory that their presence is immaterial to show what 'those forests would have died from in the absence of bark-beetles, 'instead of invoking mysterious and unnamed "diseases." The most 'serious attempt to prove another cause for the destruction of the 'trees is that of Lindeman, who associated the beetles with the 'presence of *Agaricus melleus*. This, however, appears to be un-'proved.

'5. Not a few insects feed during some part of their lives 'on or in the young shoots of Conifers, in the leader or the extrem-'ities of the lateral branches. When the leader perishes, the 'upward growth is checked until one or more branches of the top 'whorl twist round to supply its place. So lateral branches are 'destroyed or have their growth stopped, and the tree becomes

'altered in shape and appearance. Such mutilated Pines abound 'in almost all woods in the South of England.

'6. The practice of growing large pure woods of Conifers of 'uniform age tends especially to widespread ravages. Most Conifer-'feeding insects will not touch deciduous trees, and many are con-'fined to a single species of Conifer. Others, again, limit their 'attacks almost completely to a single period in the life of a tree. '*Curculio abietis* is very destructive to trees under seven years old, 'comparatively harmless to those of ten or more years. In a pure 'wood, the conditions favourable to increase of an insect pest exist 'over the whole area at once, and there is no limit to the supply of 'food, the facilities for egg-laying or for migration to fresh districts 'from the part infected.

'Under these circumstances, a bad insect attack localised in 'one spot of an extensive forest, is an exceedingly dangerous thing, 'and it has been necessary on several occasions to isolate such an 'area in a European forest and destroy it with fire to prevent the 'hatching of myriads of winged moths which would spread over 'the neighbourhood. The danger and expense of so drastic a 'measure are obvious. It is a universal rule that the larger the 'district cultivated with any particular plant, the greater is the risk 'of insect-attack, while small isolated plantations become infested 'with difficulty....."

In the body of his paper, Mr. Blandford describes what can be done to minimize the damage done by the particular insects he deals with and in conclusion he observes:—"No Conifer-wood can 'be kept free from the risk of insect-injury, unless it is freed from 'newly dead and dying wood, cut branches, and fresh stumps. There 'is no need for the systematic removal of the covering of needles, 'the natural protection to the ground, nor, as a rule, of small twigs 'and branches much under an inch in diameter.

'It is not rarely objected by those anxious to free a wood 'from insects, that this thorough cleaning is too costly to be put 'into practice. Without it the insects cannot be kept down, and 'it is for them to look at the cost of labour and the opportunity for 'disposal of such timber, and decide whether it is cheaper to let 'the insects flourish or not.

'The first cleaning-up of a neglected forest is no doubt costly, 'but after that has taken place, there is plenty of evidence to show 'that systematic and orderly removal of dead wood is profitable in 'the long run, unless exceptional destruction of timber over scat-'tered areas by storms or snowfall should unduly strain the 'forest resources.

'No one who is familiar with the pitiable appearance of a 'Pine-wood thinned out badly by *Myelophilus piniperda* can doubt 'that in this matter penny-wisdom sometimes leads to pound-'foolishness, and that in the end the practice of keeping the forest 'thoroughly clean—a practice advocated for many generations by 'scientific foresters—is the best and safest."

EXPERIMENTS REGARDING THE

Cover of trees reserved in Coppice with Standards.

An extract from a *Bulletin du Ministère de l'Agriculture* recently received, contains the results of numerous experiments made by M. Bartet, *Inspecteur Adjoint des Forêts* at Nancy regarding the Cover of Coppice Standards, by *cover* being meant the surface formed by the projection of the crown of a tree on the ground. The object of the experiments is to assist in deciding questions which the choice and application of different systems of reserving standards may give rise to. To avoid difficulties, the age of the trees has been completely ignored and in all cases the cover is compared to the diameter of the trunk taken at 1m. 30 above the surface of the ground and the cover is taken as being equal to a circle constructed with the average diameter of the horizontal projection of the crown. This surface has not been actually calculated, the calculations being restricted to determining simply the average diameter of the crown corresponding to each category of trunk diameter.

The method of measurement and the nature and situation of the trees experimented on, comprising some 616 Oak, 169 Beech, and 50 Hornbeam, are explained, and the results obtained tabulated.

The conclusions drawn from figures given in the table for the Oak are *first*, that whatever may be the nature of the soil and the age at which the coppice is exploited, the relation between the diameter of the crown and the diameter of the stem diminishes constantly as the standards increase in girth. *Secondly*, that the lateral development of the crown becomes slower and slower as the trees become old. *Third*, that for trees of a given size the diameter of the crown varies but little with changes in the rotation of the coppice or in the quality of the soil. The figures also show that so far as regards the relative development of the crown and the stem, the Beech and the Hornbeam are regulated by the same laws as the Oak.

The results obtained differ entirely from the theory hitherto adopted in the *Cours de Culture*, a difference arising entirely from the amount of cover allowed by the authors (Lorentz et Parade) for the average tree of each age class. In an example taken for a hectare, the cover obtained according to the *Cours de Culture* is not one half that obtained if the calculations be made according to the table above referred to, a result which will doubtless tend to modify the hitherto accepted principle that the standards in a coppice should not cover more than one-third of the ground immediately before the exploitation.

A. F. G.

Influence of aititude on the growth of Forests and Trees.

A most interesting paper is published in the *Allgemeine Forst und Jagd Zeitung* of November, 1892, by Dr. Seiroko Honda of Tokio on his enquiries regarding the influence of the height above the sea level on the growth of forest trees, and their reducing factor.

The enquiries and valuation surveys have been very searching and extended over areas of elevation ranging from 900 to 1050 metres, from 1050 to 1200 metres, from 1200 to 1350, and from 1350 to 1500 metres.

The results of the experiments are shortly summarized showing that with increase of absolute elevation of the locality, the following changes take place in the growth.

A.—THE INDIVIDUAL TREE.

1. The increase in height lessens regularly and distinctly.

2. The basal increase also decreases, but less so than the growth-height.

3. Increase in volume lessens gradually.

4. The stage of immaturity in all these directions is prolonged.

5. The form of the bole becomes less and less cylindrical and approaches more and more the neiloid.

6. The proportion of the increase of the several parts of the tree decreases from the bottom towards the top of the stem.

7. The reducing factor becomes smaller.

8. The crown formation gets lower in proportion to the bole.

9. The proportion of small branch wood increases.

B.—OF THE FOREST.

10. The actual number of stems per area increases, whilst, however—

11. The number of stouter and dominant trees decreases.

12 The mean height of the forest decreases.

13. The total basal area decreases, not very apparently, but belongs to a great extent to trees of inferior growth.

14. The outturn in timber, scantling and first class wood decreases distinctly.

15. The outturn in small branch wood increases to some extent.

16. Trees of the same age are more inclined to form groups

The article is worthy of perusal and study.

II.—CORRESPONDENCE.

The Departmental Blazer.

SIR,

The subject of a Departmental Blazer seems to have dropped, I hope, only temporarily, for I, for one, would gladly subscribe to the movement and get a blazer when its colour, &c., is decided on. I think the two or three shades of green already suggested by one of your correspondents, will be the most suitable arrangement of colours—three shades for choice and in perpendicular stripes.

YELLI HOITU.

NOTE.—We have been expecting a pattern from "VELLEDA,' See August No., p. 306. Would he kindly send it.

HON. ED.

Tiger skins.

Would some of your readers kindly inform me if they have shot tigers with long hair (1 to 2 inches). In Central or Southern India, I don't think the hair ever grows to this length. I have shot upwards of 30 tigers and have been at the death of some 30 more, but none of these had long hair. My reason for asking is because lately I examined two tiger-skins in a furrier's shop and they had hair from 1 to 2 inches all over. And they were priced £ 45 and £ 18 !

The former was for a very fine large skin beautifully marked. The shopman said the skin of a Bengal tiger would cost £ 8 or £10, but he had not any on stock : those he showed me, came from North China (?)

DUBLIN, E. D.

December, 1892.

The recent Bombay Rules.

SIR,

The rules concerning the relations of Forest and Revenue Officers in the Bombay Presidency, which were published in page XCVI of the October Number of your Journal indicate such radical changes of *régime*, and are withal so complicated on account of saving clauses which modify, or wholly annul other clauses of the rules, that it may not be inopportune to attempt a statement of the net results. With your permission, I will thefore, show, by means of parallel columns, the principal changes effected according to my interpretation of the rules, so far as I feel able to define them, but it will be found that some require explanation by their authors :—

Old Rules	New Rules
1. The Conservator is responsible for the management of the forests of his Circle.	1. The Collector, subject to the control of the Commissioner, is responsible for the management of the forests in his Collectorate (Rules 2, 7, 12, 13 14, 18, 22, 27).
2. The posting of Superior Executive Officers rests with Conservators.	2. The posting of Superior Executive Officers rests with the Conservator subject to the veto of the Collector (Rules 5, 7). It, therefore, may be said to rest with the Collector.
3. The appointment of inferior officers rests with the Divisional Officer subject to the control of the Conservator.	3. The appointment of inferior officers rests with the Collector (Rule 6).
4. The Conservator is Head of the Forest Department in his Circle, but correspondence between him and Government, affecting the general administration of the district shall be sent through the Commissioner.	4. The Commissioner is Head of the Forest Department in his Division, and shall settle all forest questions on which he does not consider the opinion of Government necessary; interpret Government orders; and issue orders accordingly to Collectors and Conservators (Rules 1, 28).
5. All correspondence between the Conservator and the Divisional Officer, affecting the general administration of the district shall be sent through the Collector. The Collector shall not issue orders to the Divisional Officers except in emergent cases.	5. All correspondence, without exception, between Divisional Officers and Conservators shall go through the Collectors. On the other hand the Collector shall issue such orders as he thinks fit to the Divisional Officer; his correspondence with the Divisional Officer shall be direct and not communicated to the Conservator, and in forwarding the latter's letters to the Divisional Officer, he shall issue such orders as he thinks fit on the subject of the correspondence, without interfering with purely technical details (Rule 10.)
6. The Divisional Officer subject to the Control of the Conservator, is responsible for the technical working of the forests of his Division.	6. The Divisional Officer, subject to the Control of the Collector, is responsible for the technical works of the forests (Rules 9, 12, 13, 14).

Old Rules

New Rules

Obviously the Conservator could not be held responsible for the non-fulfilment of technical works obstructed by the Collector. It is necessary to note here that with regard to the above rules 5 and 6 which seem to clash, that although an undefined current of responsibility of the Conservator in regard to "technical matters" pervades the rules, it is quite impossible in many cases to say with whom the responsibility really lies. Rule 4, taken alone, throws responsibility, generally, on the Conservator. But the principal proposition in rule 4 is "subject to the other provisions of these rules"; consequently, rule 13, for example, would efface rule 4 so far as the (pretty wide) scope is concerned, the general tendency of the rules being, however, to throw all responsibility, or as much as possible, on the Collector. I take it that he alone will be practically responsible for the proper management in all its forms of the forests, although it must be admitted that a more definite statement of the Collector's, or Conservator's, functions in this respect is desirable. Here another difficulty crops up: it appears to be impossible to draw a line between the technical and the non-technical! One is sometimes merged in or overlaps, the other; and separate responsibility in regard to the two functions will be found to represent many difficulties in practice. *Under the circumstances*, the only clear way out of the difficulty seems to be to give the Collector, in precise terms, free hand in all matters technical or non-technical, and to make the Conservators functions purely consultative.

7. The Examination of Executive Officers' offices shall be conducted by the Divisional Officer alone.

7. The examination of the Executive Officer's offices shall be conducted by the Collector and his Assistants (Rule 18. No reference is made to inspections by the Divisional Officer, and it is not, therefore, apparent from these rules whether he shall also conduct examinations or not. Nor is it stated what is to happen after the examinations by the Collector and his Assistants. Presumably, they will merely record notes on the results of their labours for the information of the Divisional Officer, because the sections of the Forest Code, under which it is the duty of the Divisional Officer to examine the offices of his subordinates, apparently still remain in force, and it would cause confusion if several were to be allowed to issue orders to a subordinate on the same subject.

PUZZLED.

III—OFFICIAL PAPERS & INTELLIGENCE.

Stamps on Forest School Students' agreement bonds.

The following order has recently been issued by Government. "In exercise of the powers conferred by Section 8, of the Indian 'Stamp Act (I of 1879), the Governor-General in Council is 'pleased to remit the duties payable on the agreements and security 'Bonds required to be executed, under the Rules to regulate ap-'pointments and promotions in the Provincial Forest Service, by 'students and their sureties previous to entry into the Forest 'School, Dehra Dûn."

Allotment to Provinces of newly arrived Forest Officers.

A recent despatch of the Secretary of State has laid down that in future Regulations it is to be settled that Forest Officers on passing out of Coopers Hill are to be "posted at the discretion of 'the Secretary of State after consulting the President of the 'College and the Principal Professor of Forestry, to the several 'Provinces according to the needs of the public service." The new rule will not come into force until the Entrance Examination of 1894.

Forest Works in the Madura District, Madras.

By the kindness of the Madras Revenue Board we have received a copy of the Conservator's recent inspection note on this District and the discussion on it. We do not propose to enter into the controversial questions of which there are many, except to remark that the system in which the Conservator and Collector both have their say and the Board decides, is a much better one than what is likely to result from the recent Bombay Rules.

The most interesting item, perhaps, is that regarding the erection in the Alagar Malai Reserve of a wire rope along which firewood is run down. The Conservator says that the wire rope is about 900 feet long which gives an incline of about 1 in 6. The Collector adds that since the Conservator's visit, the rope has worked very successfully, and as much as 37½ maunds have been run down in an hour. The wire-rope is only ⅜ inch thick and has broken twice. We should much like to hear more of this experiment and hope Mr. Gass will favour us with an account of it.

In regard to grazing, we are glad to see that the Collector approves of a distinction being made between cattle used for agriculture and others.

Although in one or two instances he disagrees with the Conservator, as, of course, must be expected sometimes, it is clear that the Collector, Mr. E. Turner, takes much interest in Forest work and understands the responsibility which rests with him regarding it.

IV—REVIEWS.

Progress Report of Forest Conservancy in Ceylon for 1891.

Our Review of the Report for 1890 was printed in the February, 1892, No. of this Journal. The Report of the year 1891 is rather more intelligible as regards the names of trees, for the scientific names are occasionally given.

The area of Reserved Forest was slightly increased, but progress is slow and as the Conservator grimly remarks "at the present 'rate it will take some 400 years to reserve the valuable forests of 'the Island if they still exist by that time." The reason seems to be that Settlement Officers are appointed but they do nothing. In one case, however, a Settlement Officer did do a little work and the result is best given in the Conservator's own words. We wonder what the Bombay Government would say to such outspoken criticism!

"One of them, however, which was forwarded for my infor-'mation, showed that the Forest Settlement Officer did not limit 'himself to the strictly legal question of admitting or rejecting 'claims, but that he allowed certain villagers rights to which no 'claim had been raised, merely because some day the want might 'arise, not because from personal inquiry he found the right to 'have previously existed. I hardly think it is the duty of a Forest 'Settlement Officer to become a philanthropist towards a small

'section of the community at the expense of the public at large. 'In the instance quoted, little harm has been done, but I think it is 'a very dangerous precedent."

Enumeration Surveys towards Working Plans have been made in several Districts and the results are given in the Report. In the Trincomalee District a valuation made at Kiripangankulam over 72 acres, gave 3 ebony, 5 satinwood, and about 28 other trees per acre on an average; while in the Northern Provinces a similar survey found only 18 trees per acre, of which 8 satinwood, and 3 ebony. The Conservator remarks that if the latter valuation is a good sample of a fairly good forest, it helps to explain why forest work in Ceylon is so expensive as compared with that in India and shews that far larger areas are required to maintain the same supply.

The following extract regarding the relations between the Revenue and Forest officers will interest our Bombay subscribers and shew them that their grievances find their counterpart, to some extent also, in Ceylon. We feel sure that the difficulties will disappear by degrees with tact and management.

"In six of the Provinces the dealings between Government 'Agents and the Assistant Conservators have, on the whole, been 'satisfactory, notwithstanding occasional friction. The Govern- 'ment Agents consider the Assistant Conservators as their Assis- 'tants in Forest matters, and entrust them largely with the Forest 'administration of their respective Provinces. Where this co- 'operation exists, the administration is by far the most successful; 'and the headmen, knowing that the Forest Officers have the Go- 'vernment Agent's support, are much more willing to help them. 'The Eastern Province and Sabaragamuwa can be quoted as 'examples in point. On the other hand, in the Western and Nor- 'thern Provinces, there is no such co-operation. The Government 'Agents give orders to subordinates without referring to the Assis- 'tant Conservators, who are in some cases left in ignorance of 'forest work which has been carried out, and of expenditure dis- 'bursed during the year. This has, in the case of the Western 'Province, led to confusion in the accounts and to an expenditure 'larger than the vote allotted. In the Central Province, the 'Government Agent declined to have any responsibility with res- 'pect to forest business, and as I received no orders from Govern- 'ment to take over the responsibility, the Assistant Conservator 'was more or less independent of all control."

The damage done by fires lit, as usual, by graziers to obtain fresh grass, is reported to be rather serious because the results are that the trees at the edges of the forest 'sholas' get burned and the grass area extends every year. This used to happen and may still happen in places in the Niligiris but there the extension of a grass fire to the sholas is prevented by the simple expedient of stripping off the turf in a belt around the shola some ten feet broad. We commend that idea to the Ceylon Foresters, but their grass may be stronger and taller than that of the Blue mountains.

Most of the valuable trees appear to have seeded well, the Halmilla (*Berrya Ammonilla*) especially so. The Conservator recommends preparatory fellings of a fairly heavy character in order to encourage the natural reproduction of most of the best kinds. It seems that Na (*Mesua ferrea*) prefers to germinate in shade as do the Dún trees (species of *Doona*) and Halmilla, while satinwood and ebony require light.

A considerable amount of planting work seems to be done in Ceylon, and in such a country, where forest conservancy has only come late and the old forests have been found nearly ruined, a large amount of work in artificial reproduction is probably necessary. As in the Nilgiris, so in the Ceylon hills, the Australian Eucalypti and Acacias have been found the most profitable of fuel trees : while in the plains districts attention has chiefly been devoted to the rearing of Teak. During the year, 475½ acres were added to the Ceylon plantations and it is creditable that most of them are recognised as successes. We note a new system of rearing teak seedlings thus described—"The seed was spread in trenches 2 in. 'deep and watered constantly. After seven days it commenced to 'germinate, the number of sterile seeds proved to be very small ;" but we are not told what was done with the seedlings, whether they were pricked out into beds or put in baskets or what.

Of works of utilization, the chief were the erection of a saw-mill at Batticaloa and of two wire-shoots each of a quarter of a mile, in the Central Province, for the Extraction of Railway fuel.

The financial results of the year were

	Rs.
Revenue	4,10,035
Expenditure	4,41,205
Deficit ...	31,170

A deficit, which, in a comparatively poor Colony, must be rather serious. Various reasons are given for it, but clearly it is due to the large expenditure on preliminary works and it is apparently expected to be early recouped. In 1890, it will be remembered, the surplus was Rs. 88,528.

We will conclude with a short extract regarding the issue of licenses for shooting elephants which will greatly amuse some of our sporting readers :—

"There has been a great deal of grumbling on account of the 'license for shooting elephants being raised to Rs. 100. I cannot 'see much cause for this grumbling. To a person who has never 'shot an elephant and who is desirous of killing one, an elephant 'should be well worth Rs. 100, and an animal of this kind should 'satisfy most men. Those who are not satisfied, should, if they are 'not willing to pay the money, confine themselves to prescribed 'rogues, which the Government Agents will gladly allow them to kill without paying for licenses."

Timber Physics.

We have received a printed copy of the first of a series of bulletins on Timber Physics compiled by Mr. B. E. Fernow, Chief of the Forestry Division, U. S. Department of Agriculture, which has been published by the authority of the Secretary of Agriculture. The object of the bulletins is to record the results of an extensive investigation into the nature of the important woods of the United States, especially their mechanical and technical properties and the dependence of these upon structure and physical condition and upon the conditions under which the wood was grown. The bulletin now under reference is preliminary in its nature, being intended to serve as a basis for the work which is to follow and is partly begun.

The first part of the memorandum is devoted to the "Need of the investigation." Mr. Fernow points out that the properties of the various timbers are not well-known and that while attempts more or less systematic have been made to determine these properties there does not exist much reliable published information for general use. Several instances are given of the waste of valuable material which has resulted from this ignorance ; for instance the employment of fine black walnut timber for fence rails, posts and firewood ; again until twelve or fifteen years ago many million feet of hemlock (*Abies canadensis*) were left to rot in the woods after the bark had been taken for tanning purposes, or this timber was not cut at all, because its value for building purposes was not understood or was underrated. Another instance is given of how, in Alabama alone, an annual saving of $40,000 to $50,000 has been effected by utilizing the wood of the chestnut oak for sleepers on the Louisville and Nashville Railroad, a large amount of which wood was a few years ago allowed to rot, the tree being felled for the tan bark alone.

Mr. Fernow states that it would be impossible to estimate the direct and indirect losses which the country suffers from ignorance as to the true values and strength of its building timbers. A *résumé* of some hundred letters received from leading engineers, scientific societies and others, is appended to his report, which, while strongly favouring the thorough investigation of the U. S. timbers, are of interest also as showing the multiplicity of directions in which the work would be of benefit.

The investigation known under the name of "Government Timber Tests," which is to be the most comprehensive of the kind ever undertaken anywhere in the U. S. or in Europe, is stated to

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"Timber Physics, Part I, compiled by B. E. Fernow, Chief of Forestry Division, Washington, 1892

differ from all former attempts in that direction, in that it starts out with the fullest recognition of three facts.

"(1). That in order to establish reliable data as to mechanical 'properties of our timbers, it is necessary to make a very large 'number of tests by which the range as well as average capabilities 'of the species is determined.

'(2). That in order to enable us to make the most efficient 'practical application of the data thus obtained, it is necessary to 'know the physical and structural conditions of the test material 'and bring these into relation with the best results.

'(3). That in order further to deduce laws of relation 'between mechanical properties and the physical and structural 'condition as well as the conditions under which the material was 'produced, it is necessary to work on material the history of which 'is thoroughly known."

After certain remarks on the necessity of making the tests on a large number of specimens of known origin and known physical condition, Mr. Fernow adds "While some experiments would lead 'us to believe that specific weight is a fair expression of the strength 'of timber of the same species, yet it would be hazardous to rely 'upon this factor without regard to other physical conditions and 'structural features of the timber."

Such ring-porous woods as the oaks and ash show the greatest strength and elasticity when their annual rings are wide, while the slow-grown mountain oak seems to excel in stiffness. From conifers, on the other hand, according to Hartig, the slow-grown timbers seem to exhibit superior quality; hence those from rich soils are not desirable. This again has appeared doubtful or, at least, true only within unknown limits from Bauschinger's experiments which showed that tensile strength in pines was independent of the total width of the annual ring but dependent on the ratio between the spring wood and summer wood. That wet soil produces brittle, dry or fresh soil tough, timber, is believed, but needs proof. Contrary to general opinion, the time of felling seems to be without influence on the strength of pines. The degree of seasoning on the other hand seems to increase the strength, although it would still have to be found out whether the manner and rapidity of seasoning may not change this result. Toughness or capacity for bending without rupture on the contrary, is claimed to be inversely proportionate to seasoning.

The second part of the memorandum treats of the scope and historical development of the science of "Timber Physics," the subject matter comprised in this branch of applied natural science being arranged as follows :—

1. Wood structure or Xylotomy.

(*a*). Exterior form (*b*) Interior structural appearance (*c*) Minute anatomy or histology, (*d*) Classification of woods according to structural features.

(*e*) Laws of wood growth (*f*) Abnormal formations.

II. Physical properties.

(*a*). Exterior appearance, (*b*) Material condition (*c*) Classification of woods according to such physical properties as determine their application in the arts.

III. Chemical properties.

(*a*). General chemical analysis of wood (*b*) Carbohydrates of the wood (*c*) Extractive materials (*d*) Antiseptic materials (*e*) Mineral constituents.

IV. Mechanical properties.

(*a*). Form changes without destruction of cohesion.

(*b*). Form changes with destruction of cohesion.

V. Technical properties.

VI. Diseases and faults.

VII. Relation of properties to each other.

The history of previous works carried out in this connection is then given and the third part of the memorandum devoted to the "Organization and methods of the Timber Examinations in the Division of Forestry."

The work, as at present organized, is carried out by four departments *viz* :—

1. The collecting department.
2. The department of mechanical tests.
3. The department of physical and microscopic examination of the test material.
4. The department of compilation and final discussion of results.

The bulletin concludes with a description of the different methods employed in carrying out the various experiments; instructions for the collection, &c., of test pieces, blank forms and illustrative records and finally drawings of the machinery, &c. required for carrying out the experiments.

V.—SHIKAR.

The Nepal Khedda on the Ganges.

With the permission of Government, the elephants of the Nepal Khedda, under the orders of the Superintendent, Major Jeet Singh Bahadur, have been permitted to march from the Nepal territory along the foot of the Himalaya in order to try and capture some of the wild elephants which are to be found in the forests of the Dún and in those on the left bank of the Ganges opposite. Accordingly, for the past two or three weeks, the whole party with no less than 275 elephants of all sizes have been camped at Chila close to Hurdwar and engaged in the endeavour to catch such herds and single elephants as were heard of in the neighbourhood. The camp was an enormous one, and a very strange sight, some of the elephants being splendid animals. Two, notably, were of enormous size and very powerful brutes, the biggest of all being a huge tusker named 'Narain Gaj.' In order to assist the Superintendant in his work, Mr. F. A. Leete, Assistant Conservator of Forests, was placed on special duty, and he has been good enough to inform us of the results to date. They have not been very successful, only ten elephants in all having been caught so far. Of these, one small calf was allowed to go and also one very old and quite useless animal ; while one other has died since capture. This reduces the spoil to ten. No captures were made in the Dún, though there was a curious incident which we describe in Mr. Leete's own words. "On the 31st, the Khedda 'crossed into the Motichur after the Bagh Rau rogue, found him, 'chased him and surrounded him ; but he showed fight and so 'Narain Gaj was brought up against him. Narain Gaj, however, 'did not stop soon enough, for he knocked the life, as well as the 'spirit, out of the tusker. The latter was knocked over and died 'on the spot and he is there now (all but his single tusk) if jackals, '&c., have not found him." This will be a disappointment to the Ex-Amir of Cabul, for the rogue had been proclaimed and Yakub Khan had obtained permission to shoot him.

Another single tusk rogue had previously been captured with some trouble near Chila. The Khedda camp will not now come west of the Ganges, but they still expect to get some good sport towards Haldukhata.

VI—EXTRACTS, NOTES AND QUERIES.

The best Engine for a Saw-Mill.

M. POWIS BALE, M. INST. M. E.

Almost every type of engine is made to do duty in a saw-mill, and as many of them are utterly unsuited to the work, the result is often anything but satisfactory both on the score of economy and effective working.

Owing to the severe and variable duty required of a saw-mill engine, it should be of especially strong and substantial construction, and able to command a uniform speed under suddenly applied loads.

After a lengthened experience, the author is of opinion that the best form of engine for driving wood-working machinery—except under special circumstances—is a long stroke horizontal high pressure, either compounded or with a condenser, or both. Some years ago, the author, in writing on some points to be desired in a saw-mill engine, mentioned the following, and as his views in this respect have not altered, it may not be out of place to repeat them.

(1) A stroke of twice the diameter of the cylinder; (2) either compounded or with a condenser, or both; (3) or an automatic expansion slide, controlled by powerful and sensitive governor gear; (4) a steam-jacketted and lagged cylinder; (5) short steam ways; (6) ample bearing surfaces, well fitted and lubricated, and an efficient method of packing; (7) large cylinder area per h. p.; (8) a fly-wheel of large diameter and extra heavy section; (9) a moderate piston speed.

Speaking generally, in selecting an engine, the chief points to be borne in mind are:—(1) The nature of the work it has to do; (2) the speed and power required; (3) the cost of fuel; and (4) if under skilled management. In a saw-mill, if the fuel be plentiful, and the management unskilled, as is often the case in isolated countries, a plain slide-valve engine would possibly suit better than a first-class one with expansion gear, condenser, &c., the loss of fuel being partly compensated for by the greater freedom from breakdowns. In this case, the engine should be arranged to cut off steam tolerably early and expand it for the rest of the stroke, and powerful governor gear should be employed. On the other hand, in establishments where large power is required and skilled management is attainable, the most advanced form of engine is in the end by far the cheapest. In cases where fuel is dear, a good

compound condensing engine can be used with advantage; but it cannot be too often repeated that, where extreme economy is required, a skilled engine driver is an absolute necessity. If the steam pressure by which an engine is worked would be likely to vary considerably, and the load likewise vary; to secure steady and even running, the engine should be fitted with valve gear having a considerable range of cut-off, combined with a powerful and sensitive governor.

In selecting an engine, a full detailed specification, giving sizes and materials, should be obtained from the maker, with his guarantee as to horse-power—brake horse-power, if possible—the engine will give out at a certain steam pressure, and that it will work at its full speed and power without excessive vibration.

See that the bed-plate and frame and working details of the engine are of ample strength, also that the cylinder has sufficient metal to allow of its being rebored several times, that the steam passages are short, that the sliding and bearing surfaces are ample, and that they are adjustable for wear. The author prefers a medium piston speed—say 500 ft. per minute, to higher speeds, as he has found the cylinders of large horizontal engines run at high speeds rapidly wear hollow.

An engine of ample, but not excessive, power, for the work to be done, should be selected, as too large an engine is as wasteful of steam as too small a one.

For saw-mill work, the author prefers the bed-plate of the engine to be on the double girder box plan, and to extend beyond the cylinder, which should be mounted on it, as this is undoubtedly the best form to resist heavy working strains. If a pair of engines are used, it will be found well to have one large fly wheel for the two engines, placing it between them, with an extra pulley for driving the main shafting. Crankshaft to be fitted with an outside bearing. Connecting rod ends to be made adjustable for wear, and fitted with straps and keys. Engine to be fitted with wide double motion bars and blocks, and made adjustable for wear. The bars should have oil recesses and grit cavities. Stop and starting valve to be provided and so arranged that access can be had to the throttle valve without disturbing the steam pipe. The steam passages should be large, short, and direct, and the clearance in cylinder as small as possible.

For driving woodworking machinery, after repeated trials, I am distinctly in favour of an engine with a long stroke, as it permits a higher piston speed without excessive vibration and wear and tear, and the steam can be expanded with greater facility. The steam ports should be as short as possible. This can be secured by dividing the slide valves, placing them at each end of the steam chest; and a high-speed sensitive governor should be arranged to act on an equilibrium double-beat thottle valve, or on expansion gear. The exhaust should be of ample size, to admit of the instant

escape of the steam and avoid back pressure. In crowded spaces it is sometimes necessary to use a vertical engine ; these can be compounded with advantage, and although necessarily of shorter stroke, they can be worked with less wear to the piston, cylinder, glands, &c., than a horizontal engine, the wear being distributed, whilst in a horizontal engine the cylinder wears oval.

Arrangements should be made for the continuous drainage of the cylinder, and it should be fitted with a good sight feed lubricator, which is a distinct improvement over ordinary grease cups, as with these latter the piston may be running perfectly dry, and the cylinder may be scored and the rings cut out before the attendant is aware of it. A very considerable economy in oil is also effected by the use of a sight-feed lubricator as it can be adjusted to supply the minimum amount of oil to keep the cylinder properly lubricated. On the other hand, the old-fashioned grease cup floods the cylinder with oil for a short time, and, this being rapidly cleared away by the strokes of the piston, the cylinder is left comparatively dry in a little time.

Compound engines have of late years come considerably into use, and are more economical than single cylinder engines. This arises chiefly from the fact that much higher pressures of steam can be expanded with greater advantage in two cylinders than in one, and without the considerable loss from condensation which arises in a single cylinder when the steam is cut off very early in the stroke. Again, if a considerable range of expansion be attempted in a single cylinder, and the cut-off is very early, the strain on the working parts is great, necessitating excessive weight and strength in the engine. In the case of compound cylinders, however, this strain is distributed.

In single cylinders, if large expansion be attempted, the steam condensation is excessive and becomes a serious matter. Compound engines will work more steadily and with less friction and vibration, consequently the general details of the engines may be made lighter. Where a sufficiency of water is obtainable, a condenser can be fitted to an engine with considerable advantge, as in this case, instead of being exhausted into the open air or water tank after each stroke of the piston, the steam passes through the exhaust part into the condenser, and, coming in contact with the water, which is in constant circulation therein, is itself immediately condensed or reduced to water. In working the condenser, an air pump is employed, which keeps up a vacuum and relieves the piston from back pressure, thus increasing the effective power of the engine. The water made hot by the condensation of the steam is again used to feed the boiler, hence a second saving arises.

A simple and convenient arrangement for working the air-pump for a condenser is to prolong the engine piston-rod through the back cylinder cover. The air-pump should be double acting, and the valves arranged so as to give ready access for adjustment and repairs. The engine-bed should be prolonged and

the condenser mounted on it, so as to secure perfect alignment. The author has found pump valves of indiarubber, with gun metal seats, guards, and bolts, work very well. If there is no overhead tank for the injection water, sluice valves will be found most useful for starting the engine.

Automatic expansion gear is especially useful in a saw-mill, and with varying loads effects a considerable saving, as the admission of the steam is regulated according to the speed or load on the engine. The gears of Corlis & Proel have proved themselves very effective.

Another advantage arising from the use of automatic expansion gear is that the steam is always delivered to the cylinder at the highest available pressure, whilst in the case of an ordinary slide valve engine where the cut-off of the valve is always positive, the admission of the steam is governed by means of a throttle valve the action of which "wire draws," and reduces the pressure of the steam. With efficient expansion gear the amount of steam required to do the work on hand at the moment is practically measured at every stoke of the engine, and no more is used than is required, and this in turn is fully exhausted of its energy by expansion.

Owing to the constant and great variation of the load in a saw-mill, it is important that a governor be fitted sufficiently powerful to keep the engine perfectly under control, and the speed uniform. Various forms of high speed governor have come into use, and several of these have proved themselves both sensitive and quiet in action, and are to be preferred to the older-fashioned type.

Another very satisfactory arrangement of automatic expansion gear is the Ruston. In this the cut-off valve is made multiple ported to give free admission of the steam, and is driven by a radius rod, the free end of which is moved up or down in an oscillating slot-link, which is driven by a separate eccentric, the precise position of the rod being determined by the governor. As the speed of the engine increases and the governor balls rise, the travel of the expansion valve is reduced, and the steam is cut off earlier; should the engine run more slowly, the contrary occurs. The range of cut-off is from a fraction up to half a stroke.

For the guidance of readers, I append a specification of a high-class engine, well adapted for saw-mill work :—One improved horizontal compound tandem condensing engine to indicate 340 horse-power mounted on double girder box plate, planed on face; high pressure cylinder, 18 in. diameter; low pressure cylinder, 34 in. diameter; stroke of pistons, 36 in.; number of revolutions per minute, 90; d iameter of vertical air pump, 20 in.; stroke of vertical air pump, 18 in.; diameter of horizontal air pump, 14 in.; diameter of crank shaft, 10 in.; made of best fagotted scrap iron; diameter of fly-wheel, 18 ft.; width of face of fly-wheel, 28 in; diameter of stop valve on high pressure cylinder, 5 in.

To be fitted with Corliss' Variable Expansion Gear, on high-pressure cylinder, and ordinary slide valve on low-pressure cylinder. The cylinder to be made of best hard cold blast iron, to be steam jacketted, and with steam chest to be fitted and lagged. Connecting rod, slide and pump rods, to be of best faggotted scrap iron, and the piston rod, pins, keys, &c., of steel. All pins, joints, &c., subject to special wear, to be case hardened. Valves and plunger of pump to be of gun metal. All journal bearings to be of best gun metal or phosphor bronze, to be made adjustable for wear and efficient means of lubrication to be secured. An efficient sight feed lubricator to be fitted to steam cylinder, eccentric straps to be of gun metal, and made adjustable for wear. The whole to be finished to the satisfaction of Mr.———,

In conclusion, I may add :—Do not be persuaded into purchasing a low priced engine or boiler under any circumstances, as you may rest assured that it is impossible to purchase a first-class equipment at the price of a common one. The loss sustained in a day by using a poor engine and boiler may not be great, but this, multiplied by a series of years, may amount to an enormous sum ; in fact, in some cases, enough to buy a first-class plant several times over.—(*Timber Trades Journal.*)

Edinburgh University Forestry Lectures.

The introductory lecture to the Course on Forestry in the Edinburgh University was delivered recently by Colonel Bailey in the Agricultural Classroom. Among those present were Professor Bayley-Balfour, Professor Wallace, Dr. Cleghorn, of Stravithie, Colonel Dodds, &c.

Colonel Bailey said that originally it was intended to complete the entire series of about one hundred lectures before the close of the winter season ; but, after consulting several gentlemen well qualified to offer an opinion on the question, he had decided to ask the permission of the University Court to divide his course into two parts. The first part would deal with forest botany, or the structure and growth of trees ; and the second part with sylviculture, comprised under which would be the habits of trees and their behaviour under the influence of heat, light, moisture, climate, various classes of soil, &c., the more important sylviculture systems under which trees were grown in masses, and the creation and treatment of woods under these systems. These two subjects would occupy the winter season, and the other subjects—such as mensuration and valuation; working plans, or the organisation of woods in such a manner that they might best fulfil the objects for which they were maintained; forest pathology, or the diseases of trees and their treatment; and the utilisation of forest produce—would be taken up during the summer, when opportunities for making excursion

were greater than during the winter season. The new arrangement would have this advantage also, that if he could alternate the first and second parts in such a way that the second part might be taken first next year, and the first part second the year after, and so on, a student would be able to follow the whole course, either in a single year or in two consecutive winters or two consecutive summers. Colonel Bailey then explained further the nature of the course—mentioning that he meant to use Dr. Schlich's "Manual of Forestry" in dealing with the general part of sylviculture. He had been told, regarding books originating elsewhere than in the United Kingdom, that it was sometimes objected that they taught "Continental forestry," which did not apply to this country. But he did not recognise Continental, Scottish, or any other special kind of forestry. The principles which should guide the forester were the same all over the world, and these were what he proposed to set forth in that part of the course. He was aware that there were some excellent books on the subject by Scottish authors, but these would have greater value in the special part of the course rather than in the general part of which he was now speaking. The more their eyes were opened by a study of the general principles on which the science of forestry was based, the better they would be able to appreciate the special conditions with which they had to deal and the sooner they would be able to assist in building up, for the treatment of each species of tree flourishing in this country, a complete system which could be unhesitatingly accepted by their successors as one which rested on a solid foundation of recorded facts to the observation of which they would be guided by the researches conducted by the most eminent foresters the world had produced. In concluding, Colonel Bailey said he might mention a document that recently came into his hands, viz., the Board of Agriculture's building specification, which did not permit the use of Scottish timber in agricultural buildings without special permission. It permitted the use of Canadian, Norwegian, and American timber, but not Scottish timber, without special permission. That seemed to him to be a slur on the proprietors and forests of this country. He was in correspondence a short time ago with a proprietor in the North, who said to him, "What is the use of our learning forestry in this country? Here we are prohibited by the Board of Agriculture from using Scottish timber for building purposes." He (Colonel Bailey) wrote back to him and said that "if there is any 'such provision it must be because you grow bad timber. I do not 'believe the Board of Agriculture desires to prevent the use of good 'timber." He (Colonel Bailey) got the specification, and there he found it stated that Scottish timber could not be used without special permission, and that that should only be accorded by the inspectors when it was sound and seasoned, showing that the experience of the Board of Agriculture had been that proprietors were in the habit of using timber of a bad sort. What he (Colonel Bailey) would like to see established would be such a mode of wood

management in this country that the Board of Agriculture should revise that specification and should strike out this evil and, he would venture to say, insulting clause. (Applause). He perhaps would not give offence if he added a few remarks on the extraordinary ignorance which seemed to prevail regarding this matter of forestry. It was his belief that very few people outside of what he might call the "magic ring" realised that there was anything in it. A man who lived in the country and had seen trees as he walked, perhaps, to and from church, fancied he knew all about them. He fancied that Professor Bayley-Balfour, and Professor Wallace, and some others in the room could tell them a different story. He ventured to think it was a very wide and a very abstract science, that required deep study and that involved a knowledge of several cognate sciences. He hoped the time was not far distant when they would find that the people of this country were as thoroughly acquainted with the general facts of the question as he knew they were in France and Germany.—(*Timber Trades Journal.*)

Burmese Amber.

Dr. Otto Helm, of Danzig, has submitted the following report on a piece of Burmese amber. He writes ;—Dr. Fritz Noetling, under orders of the Director of the Geological Survey of India, has sent me a piece of amber-like resin from Upper Burmah. I have, as far as the small quantity of material would permit, made a chemical and physical examination of the specimen, and I hope to follow the publication of this preliminary investigation with a further contribution.

The fragment under examination is covered with a thin weathered crust of a brown colour. When broken it exhibits a shining, conchoidal fracture, with a greasy touch. The internal colour is dark yellow, some parts being transparent, and others sub-transparent, the latter being beclouded with organic matter, finely disseminated through the substance of the resin. The specimen exhibits a fine blue fluorescence. If light be sent into the interior with a convex glass lens, the cone of light appears of a golden yellow colour. In polarised light, the same colour is exhibited, changing, however, by revolution of the Nicols through 90° to blue and orange.

The resin is as easy to cut, saw and polish as the Baltic amber (Succinite); it is a little harder, however, than the latter, its hardness varying between 1·5 and 3.

Its specific gravity is 1·034.

As to the chemical constituents of this fossil resin, I am not yet able to give an ultimate analysis, as the piece in my possession

exhibits no portion of perfectly clear colour, but is clouded throughout by finely disseminated particles. I have, nevertheless, made a dry distillation of the resin, and the results are extraordinarily interesting and different from those which other fossil resins give under like conditions. During the distillation, for which I used a glass retort, there first appeared a white vapour cloud, which, on cooling, condensed to water-white drops ; subsequently the vapour became tinged with yellow and condensed in thin oily streaks ; ultimately, the cloud was dissipated and thick oily drops flowed into the receiver. The distillate is a brownish yellow oil, with tarry consistency, of a peculiar burnt smell and an extremely small quantity of a watery liquid. I treated this liquid with hot water and filtered : it was water-white, and gave an acid reaction with litmus paper. On repeated distillation over a steam bath, a liquid distilled over and a yellowish residue remained behind which I cleaned by solution in water with subsequent filtration and evaporation. The small quantity of crystals thus obtained I recognised, by well-known reactions, to be pyrogallic acid, whilst the aqueous distillate contained formic acid. Succinic acid was not found in the products of distillation.

The resin contained 0·6 per cent of ash which was composed of iron-oxide, sulphuric acid, carbonic acid, and lime. I found a very small quantity (0·013 per cent.) of sulphur in combination with organic substances.

The fusion point of the resin cannot be determined, as before that point is reached it decomposes with evolution of a white aromatic vapour.

The resin proved to be very resistent against solvents :—Chloroform dissolves only 2·2 per cent of it. Alcohol dissolves 0·8 per cent, the solution leaving behind, on drying, a black-brown resin. Ether dissolves 2·4 per cent, the solution leaving, on evaporation, a clear yellow resin. By oil of turpentine 18·5 per cent was dissolved, whilst carbon bisulphide dissolved 4·6 per cent.

If the pulverised material is treated with concentrated sulphuric acid, the resin gradually dissolves, forming a solution of a red-brown colour, which blackens on heating. When the red brown solution is treated with water, a dirty white deposit separates out. Concentrated nitric acid at the ordinary temperature has little effect on the resin, but on heating, the latter is changed into a yellow friable substance.

By friction, the resin becomes electric, and retains its electricity for some time.

From the foregoing investigation, it seems that the Burmese resin differs from all the fossil resins with which I am, up to the present, acquainted ; and I shall continue this research as soon as further specimens of clear colour are available. *(Memoirs of the Geological Survey.)*

The Timber trade on the Yangtse.

The British Consul at Hankow noticing a great growth in the timber trade in the great river owing to the decrease in the inland transit dues, says that for many years the high transit duties imposed, amounting often to over 100 per cent., *ad valorem*, checked the trade, which the natural features of the country—steep declines easily formed into timber-shoots and swift torrents capable of floating the timber to navigable streams—should have facilitated, and which the very low charge for labour in the forest regions should have made profitable. Lately, however, these dues have been lightened, and the consequence has been an enormous extension of the timber trade at Hankow. Most of the timber goes down the river in the form of huge rafts. These, with the huts erected on them for the raftsmen, looking like floating islands, are a remarkable feature of the river landscape of the Yangtse ; and the floating timber yards where these rafts are lashed together reach for some six miles along the north bank of the Yangtse at Hankow. The value of these rafts must be enormous, but they do not appear in the trade returns for the port. Owing to the increase of both rafts and foreign shipping, collisions were at one time frequent, giving rise to acrimonious and troublesome disputes, which, however, the Consul has now succeeded in obviating by inducing the Chinese to accept certain simple regulations.—(*Weekly Times*).

VII—TIMBER AND PRODUCE TRADE

The Timber trade of 1892.

We quote the following extracts from Messrs Churchill and Sim's Wood Circular of January 2nd 1893 as likely to be of interest to our readers.

The wood trade of the United Kingdom for 1892 has not resulted so satisfactorily for importers as in 1891, although it has been larger in extent. In the last-named year, buyers derived special advantages from continuous rise of prices at the shipping ports, and, in the autumn, from a considerable advance in freights ; a combination which necessarily added materially to the selling values of all earlier importations. The trade of 1892 was not favoured in the same way by a constantly increasing cost of supply, but there was nevertheless no reason to complain of a course of free on board markets which continued remarkably steady throughout, while freights, as in the preceding year, rapidly advanced towards the end of the season. On the whole a good year's business may be reported; if not rateably so profitable as that of 1891, the greater volume of it may be expected to have nearly made up the deficiency,

and this seeing the difficulties created by the prevalence of strikes in many of the greatest trades and industries of the country, may be considered as a fortunate outcome.

The following tables, compiled at the Custom House, will show the extent of the trade in recent years in respect both to volume and value ;—

Wood Imported into the United Kingdom in the following years :—

	1885.	1886.	1887.	1888.
Colonial Deals, Battens, &c, ...	995,373	948,349	866,857	921,887
,, Timber and Hardwoods	255,264	159,014	163,751	186,902
Foreign Deals, Battens, and Boards ..	3,234,944	2,834,851	2,926,820	3,414,197
Foreign Timber and Hardwoods	1,679,397	1,418,978	1,551,598	1,795,347
Colonial and Foreign Staves ...	124,374	130,708	137,410	143,872
Total, in Loads...	6,289,353	5,491,000	5.646,430	5,462,205
Value ...	£14,758,747	£12,135,264	£11,684,953	£14,270,696
	1889.	1890.	1891.	1892.
Colonial Deals, Battens, &c. ...	1,233,750	1,185,205	890,597	1,212,177
,, Timber and Hardwoods	227,229	180,066	151,828	194,654
Foreign Deals, Battens, and Boards ...	4,085,000	3,593,109	3,487,855	3,881,432
Foreign Timber and Hardwoods	2,162,262	2,098,308	2,099,749	2,274,486
Colonial and Foreign Staves ...	170,155	155,995	130,101	136,063
Total, in Loads...	7 878,396	7,212,683	6,760,130	7,699,512
Value ...	£19,471,566	£16,766,018	£14,479,138	£16,679,525

East India Teak.—The importation of Timber and Planks has been :—

	1886.	1887.	1888.	1889.
	19,000 Loads.	9,100 Loads.	12,270 Loads.	19,407 Loads.
And the deliveries	11,144 ,,	12,241 ,,	16,618 ,,	15,899 ,,
		1890.	1891.	1892.
	...	16,000 Loads.	16,588 Loads.	7,923 Loads.
	...	17,140 ,,	14,371 ,,	10,455 ,,

The severe depression prevailing in the shipping trade has had a very prejudicial effect upon the market for this Timber. The chief demand comes from the ship-building yards, but with freights ruling at very unprofitable rates, orders for fresh tonnage have naturally been reduced recently, and consequently, though both supplies and prices have been moderate no signs of life have been seen in the trade, and a serious decrease has taken place in consumption. Planks, on the other hand, owing to cheapness, have been used more freely than before for other purposes than ship-building, and it is fortunate in these bad times that a wider market has been found for them. On the whole, prices have been fairly steady during the year, for which thanks are due entirely to a great decrease in supplies. Prospective supplies likewise promising to be of a moderate character, a slight impetus to demand would quickly alter the position considerably for the better.

Ebony.—Ceylon.—Importers' stocks were cleared early in the year, and it was several months before any fresh supplies came forward, by which time prices had considerably advanced, and for

large, good, wood high figures could have been made; but the import, although small in total quantity, was mostly of a poor character, and therefore only realised low prices. Unsold stocks are now light, and for fresh arrivals of large, sound wood, good prices could be made, but small and poor logs should not be sent, as the market has been too freely supplied with wood of this character from other districts. Quotations are from £6 to £8 for ordinary to fair, and from £10 to £16 per ton for good to prime, large logs. EAST INDIA—was imported very freely during the first half of the year, and as at the same time the demand fell off, prices, which were good at first, soon declined, and it became difficult to effect sales. This description, owing to its inferior colour, has not maintained its position in the trade, and although more sales have been made recently, much lower prices had to be accepted and a conidderable stock remains on hand. Quotations are from £5 to £8 per ton.

SATINWOOD, EAST INDIA.—Early in the year *logs* sold well, but as shipments increased, stocks accumulated, and prices declined, sales becoming difficult as the consumption of this description has never been large. Figury and large logs were generally saleable at fair prices, but for small and faulty wood very low rates had to be accepted. The import was the largest for many years, but it was all sold, and small parcels of really good logs might now be sent. *Planks* and *boards* were not shipped, and consignments cannot be recommended, as they are never asked for.

PADOUK.—The demand for this wood considerably increased, and supplies are now needed, as there is no really good wood in stock. Only two cargoes were sent here, and of these but little remained for home consumption, as the bulk was purchased immediately for shipment to the United States. Quotations are—for logs and planks from 2s. 9d. to 3s. 6d, per foot cube.

MARKET RATES OF PRODUCTS.

(*Tropical Agriculturist, January, 1893.*)

Cardamoms	per ℔.	2s.	to	2s.6d.
Croton seeds	per cwt.	15s.	to	20s.
Cutch	,,	20s.	to	32s.
Gum Arabic, Madras	,,	40s.	to	80s.
Gum Kino	,,	100s.	to	120s.
India Rubber, Assam	per ℔.	1s.6d.	to	2s.1½d.
,, Burma	,,	1s.5d.	to	1s.9d.
Myrabolams, Bombay	per cwt	9s.	to	10s.6d.
,, Jubbulpore	,,	8s.4½d.	to	9s.6d.
,, Godavari	,,	8s.	to	9s.
Nux Vomica, good	,,	8s.	to	9s.6d.
Orchella, Ceylon	,,	22s.	to	28s.
Redwood	per ton	£3	to	£3-10s.
Sandal wood. logs	,,	£35	to	£60
,, chips	,,	£9	to	£30

VIII.—EXTRACTS FROM OFFICIAL GAZETTES.

2.—MADRAS GAZETTE.

22nd December, 1892.—No. 2.—Mr. H. McIntosh, Assistant Conservator of Forests, Second grade, to act as District Forest Officer of Cuddapah during the absence of Mr. F. A. Lodge on leave, or until further orders

23rd January, 1893.—No. 25.—

NAME.	Present grade.	Grade to which promoted.	Nature of promotion.
Mr. T. G. A. Gaudoin	Sub-Assistant Conservator of Forests, 2nd Grade.	Extra Assistant Conservator of Forests, 4th Grade.	Permanent-

3.—BOMBAY GAZETTE.

3rd January, 1893.—No. 26.—Hari Bhau Ubha, inhabitant of Mohadi in the Ahmednagar District and late a forest guard in the Igatpuri Range of the Násik Forest Division, having been convicted under Section 161 of the Indian Penal Code, is hereby declared incapable of serving Government again in any capacity.

4th *January*, 1893.—No. 74.—His Excellency the Governor in Council is pleased to appoint—

Mr. G. P. Millett to be Divisional Forest Officer, North Thana;

Mr C. Greatheed to be Divsional Forest Officer, South Thana;

Mr. A. C. Robinson, .L C. E., to be Extra Assistant Conservator of Forests, Southern Circle.

9th January, 1893.—Mr. L. D. Joshi, Extra Assistant Conservator of Forests, delivered over charge of the Sub-division Office, Satara, to Mr. B. M. Kharkar, Huzur Deputy Collector, Satara, on the afternoon of the 3rd December, 1892, and received charge of the Sub-Division Office, East Khandesh, from Mr. B. H. Dalal, Extra Assistant Conservator of Forests, on the 15th idem, before office hours.

2. Messrs. G. S. Hinge and B. H. Dalal, Extra Assistant Conservators of Forests, respectively delivered over and received charge of the West Khandesh Sub-Division Forest Office on the afternoon of the 17th December, 1892.

3. Mr B. M. Kharkar, Huzur Deputy Collector, Satara, delivered over and Mr. G. S. Hinge, Extra Assistant Conservator of Forests, received charge of, the Satara Sub-Division Forest Office on the forenoon of the 20th December, 1892.

17th January, 1893.—Mr. G. P. Millett, Deputy Conservator of Forests, Fourth Grade, and Mr. C. Greatheed, Deputy Conservator of Forests, Third Grade, respectively delivered over and received charge of the South Thana Forest Division on the afternoon of the 10th January, 1893.

4.—BENGAL GAZETTE.

3rd January, 1893,—No. 13.—Mr. C. S. Murray. C. I. E., Assistant Commissioner, Chittagong Hill Tracts, was in charge of the Chittagong Forest Division, from the afternoon of the 10th July, 1892, to the afternoon of the 26th August 1892, when he was relieved by Mr. C. G. D. Fordyce, Officiating Deputy Conservator of Forests, second grade.

24th January, 1893.—No. 363.—Mr. A. H. Mee, Officiating Extra Assistant Conservator of Forests, 4th grade, is confirmed in that appointment, with effect from the 28th October, 1892.

24th January, 1893.—No. 391.—Mr. R. Quinnell, Extra Assistant Conservator of Forests, 1st grade, in charge of the Palamau Forest Division, was reduced to the 2nd grade of Extra Assistant Conservators for a period of three months, with effect from the 22nd June, 1892.

5.—N. W. P. AND OUDH GAZETTE.

CORRIGENDA.

24th January, 1893.—No. 478A-10.—For rule 4 of Notification No. 391, dated 28th February 1880, substitute the following :—

The Collector of Bijnor to be Forest Officer within defined limits.

"The Collector of Bijnor is appointed to be Forest Officer within the limits of his district, and to exercise the powers of a Conservator of Forests in respect of those forests which are not under the immediate control of a Divisional Officer of the Forest Department"

In Notification No. 302, dated 28th February, 1880, omit the words "the Deputy Commissioner of Jhansi, the Deputy Commissioner of Lalitpur."

In rule 5 of Notification No. 1004, dated 2nd November 1880, omit the words "the Deputy Commissioner of Lalitpur."

6.—PUNJAB GAZETTE.

16th January, 1893.—No. 31.—Messrs. G. G. Minniken and L. Gisborne Smith, Deputy Conservators of Forests, respectively made over and received charge of the Bashahr Forest Division on the forenoon of 10th January 1893 consequent on the former's departure on the privilege leave for one month and ten days granted to him in Punjab Government Notification No. 595, dated 24th December, 1892.

17th January, 1893.—No. 36.—Under the provisions of Section 2 of the Indian Forest Act, VII of 1878, the Hon'ble the Lieutenant-Governor is pleased to appoint Captain J. S. E. Western, 1st Punjab Cavalry, to be a Forest Officer in respect of the Bandan Rakh at Dera Ismail Khan.

19*th January*, 1893.—No 44.—Babu Ladha Singh and Mr C. F. Rossiter, Extra Assistant Conservators of Forests, respectively made over and received charge of, the Montgomery Forest Division, on the forenoon of 6th January 1893, consequent on return of the latter from privilege leave.

24*th January*, 1893 —No 57.—Babu Ladha Singh, Extra Assistant Conservator of Forests, has been attached to the Mooltan Forest Division with effect from the forenoon of the 10th January 1893

7.—CENTRAL PROVINCES GAZETTE.

4*th January*, 1893 —No 47.—The twelve months' leave on medical certificate granted to Mr F S. Barker, Deputy Conservator of Forests, under Article 343 of the Civil Service Regulations, in General Department Notification No 8752, dated the 23rd December 1891, is commuted into furlough without medical certificate under Article 340 (*b*) of the Civil Service Regulations

Notification No. 8752, dated the 23rd December 1891, is hereby cancelled.

8.—BURMA GAZETTE

29*th December*, 1892.—No. 466.—Mr Frederick Ryan, who has been appointed on probation an Extra Assistant Conservator of Forests in this province, reported his arrival in Rangoon on the afternoon of the 19th December, 1892

Mr Ryan is posted to the Myanaung Subdivision of the Western Forest Division, Pegu Circle.

17*th December*, 1892 —No 17. With reference to Revenue Department Notification No 437 (Forests), dated the 8th December, 1892, Mr R F Lowis, Extra Assistant Conservator of Forests, assumed charge of the Ruby Mines Subdivision of the Katha Forest Division on the forenoon of the 23rd November, 1892.

6*th January*, 1893.—No. 3 —In exercise of the power conferred by section 3 of the Burma Forest Act, 1881, and section 2 of the Upper Burma Forest Regulation, 1887, respectively, and in supersession of this department Notifications Nos 110 and 111 (Forests), dated the 28th March, 1892, the Chief Commissioner appoints the following Extra Assistant Conservators of Forests to discharge the functions of a Forest Officer, and to exercise all the powers conferred on Sub-Assistant Conservators by the rules hitherto made under the enactments in question :—

Mr. C Ingram	Mr. W. A. Hearsey.
Mr. J. Allmark.	Mr R. F Lowis.
Maung Kalè	Mr. Maung Wè
Mr C. W. Allan.	Mr. P W. Healy.
Mr D. L K Calderwood.	Mr M Kavanagh
Mr. W J. Lane-Ryan.	Mr. C W. B. Anderson.
Mr E. B. Powell.	Mr. Frederick Ryan.

27*th December*, 1892,—No. 1.—With reference to the Revenuh Department Notifications Nos. 343 to 347 (Forests), dated the 19te

October 1892, Lieutenant H. N. Warde, Assistant Commissioner, reported his arrival at Pakôkku for forest settlement duty on the afternoon of the 29th November 1892.

9th January, 1892.—No. 1.—With reference to Revenue Department Notification No. 460F., dated the 20th December 1892, Mr. G. R. Long, Assistant Conservator of Forests, relinquished charge of the Myanaung subdivision on the afternoon of the 18th ultimo

10th January, 1893.—No. 1.—Mr. C. Ingram, Extra Assistant Conservator of Forests, made over, and Mr. G. R. Long, Assistant Conservator of Forests, received charge of, the South Tenasserim Division on the afternoon of the 30th December 1892.

— No. 2.—Mr. C. Ingram, Extra Assistant Conservator of Forests, availed himself of the three months' privilege leave granted in Notification No. 451 (Forests), dated the 13th December 1892, on the 31st December 1892.

20th January, 1893.—No. 25.—Mr. D. L. K. Calderwood, Extra Assistant Conservator of Forests, is transferred from Mandalay to the Lower Chindwin Forest Division,

20th January, 1893.—No. 26.—Mr. M. Kavanagh, Extra Assistant Conservator of Forests, is transferred from Alôn to the Mandalay Forest Division.

17th January, 1893.—No· 2.—With reference to Revenue Department Notification No. 466, dated the 9th December 1892, Mr. F. Ryan, Probationary Extra Assistant Conservator of Forests, assumed charge of the Myanaung subdivision of the Western Division on the forenoon of the 4th January 1893.

9.—ASSAM GAZETTE.

21st January, 1893.—No. 396J.—Privilege leave of absence for two days, under article 291 of the Civil Service Regulations, is granted to Babu Jogesvar Sur, Extra Assistant Conservator of Forests, Assam, in extension of the leave granted in Notification No. 8379G., dated the 15th September 1892.

10.—HYDERABAD RESIDENCY GAZETTE.

10th December, 1892.—No. 371.—The Resident is pleased to declare that Mr. Sreenivasuloo Naidu, an Extra Assistant Conservator of Forests in Berar, has passed the examination prescribed for Forest Officers in the Hyderabad Assigned Districts in Marathi by the Lower Standard.

APPENDIX SERIES

OF

THE INDIAN FORESTER.

TANS OF SOUTHERN INDIA.

In the course of a recent correspondence with Messrs. Cammiade Brothers, Madras, with reference to the possibility of obtaining a supply of the pods of *Cæsalpinia digyna* as a tan, I received from them the following interesting letter on the subject of the tanning materials used by them:—

"We use largely the bark of *Cassia auriculata* and myrabolans. The bark of *Cassia Fistula* is also much used in Madras, particularly since a year or so.

"Divi-divi (*Cæsalpinia coriaria*) is not procurable regularly, so it cannot be relied on for tanning purposes. If it were grown more abundantly, and if the cultivators understood how to pick the pods at the right time, when it is in prime condition, and if they sorted their divi-divi and kept it from rot, this tannin would be valuable for cheap tannages. It is suitable for heavy hides, making very firm leather, but of a dark colour.

"Myrabolans are used principally for colouring skins or hides. Some kinds give a very good colour. It is also used in tanning in a process which consists in sewing the prepared hide like a bag, which is suspended, and in which a decoction of myrabolans is placed, and forced by the pressure of the liquid to percolate through the hide. This is a very inferior tannage, but it is cheap and soon completed. Myrabolans ferment too soon to be of use as other tannins, *e.g.*, the generality of barks.

With wattle* (Nilgiris) we have had no experience. We know that it is very good for heavy hides, and that it makes very firm leather, but of bad colour.

Cassia auriculata bark when cured with care and used within a short time, yields a very fair colour which, however, soon changes into a murky brown. Another great fault is its price. It costs in Madras about R20 per candy of 500lbs., whereas a cord of hemlock bark (*i.e.*, a ton) costs from 6 to 10 dollars to tanners in the United States, and for equal quantity of bark used hemlock gives more weight to leather.

"The bark of *Cassia Fistula* is cheap, but it yields leather of a dark colour.

"Colour is of secondary importance in the tannage of heavy hides. It is of paramount importance in the tannage of small hides, and especially of goat and sheep skins. The specialty of Madras is to tan light hides, and goat and sheep skins.

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* In the "Révue Agricole," Mauritius, April 1892, the black and golden wattles (*Acacia decurrens* and *A. pycnantha*) are said to be the principal trees which yield tan, and to be quick growers and easily cultivated. It is calculated that 100 acres of wattle plantation will give, in a period of eight years, a net income, after deducting all expenses, of £2.637 or £3·5 per acre per annum. The bark of these wattles is said to contain from 40 to 45 per cent. of tannin.

The wattles cultivated on the Nilgiris are *Acacia dealbata*, *A. decurrens*, and *A. melanoxylon*.

"The pods of *Cæsalpinia digyna* are said to yield leather as white as snow. If that report is correct, this tannin ought to cut out all others in Madras, provided it can be grown cheap. Hence our desire to experiment with the pods, of which we have been promised a sample through friends at Cuttack."

In a communication to 'Leather,' Mr. Evans, Chemist of the Tanner's Laboratory, Bristol, says that "the pods of a plant from India, which must certainly have been brought to England before, were sent to us as something new. They proved to be the pods of *Cæsalpinia digyna*, and, presuming they can be cultivated to any extent, the importers may be congratulated on their good fortune. They yield about 33 per cent. of tannic acid, which is in some measure like that of babúl (*A. arabica*) pods, which give a cream-coloured precipitate; but this unites with gelatine in the form of a precipitate as white as driven snow, and its reactions with other chemicals give divers colours, which will make it equally attractive to the dyer. In saying this much we can say with satisfaction, as a chemist, that it is almost perfect: what may be its behaviour in the tannery remains to be proved."

In the 'Dictionary of Economic Products' *C. digyna* is described as a prickly tree of the Eastern Himalaya, Eastern and Western Peninsulas, and Ceylon. Dr. McCann, in his 'Dyes and Tans of Bengal,' says that, in Cuttack, the pods of what appears to be this plant are sold as a tan under the name of *kunti*. The word *kunti-paras* would appear to be sometimes, in Orissa, applied to *Butea frondosa*, but incorrectly as *kunti* means tanning pods, and *paras Butea frondosa*; in other words, the term *kunti paras* would mean the tanning pods of *Butea*, and not of *Cæsalpinia*". (L. Liotard.)

INDIAN MUSEUM,
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Govt. of India Central Printing Office.—No. 624 R. and A.—12-1-93.—440.—W.S.

THE

INDIAN FORESTER;

A MONTHLY MAGAZINE

OF

FORESTRY,

AGRICULTURE, SHIKAR & TRAVEL

EDITED BY

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VOL. XVIII, 1892.

MUSSOORIE:

PRINTED BY THE MAFASILITE PRINTING WORKS COMPANY, "LIMITED."

1892.

Index. 1892.

Vol.—XVIII.

I.—ORIGINAL ARTICLES AND TRANSLATIONS.— *Page.*

A Tour through Kamraj-Kashmir, by J. C. McD. 1,41, 81, 127, 175
Sledge-Roads in France and in India—a letter from "Q" with translation, from the *Revue des Eaux et Forêts* ... 5
Practical Forest training grounds for the Coopers Hill College, by W R. Fisher ... 12
An interesting new product 19
Leaf-fungus on *Ehretia serrata* 21
The Tortrix of the Teak tree, by J. N. ... 46
Famine and the forests of Bellary ... 48
Forest petitions in Ganjam 50
Kashmir products, by B. P. 51
The ferns of Pachmarhi and those of Mahendragiri, by J. S. Gamble ... 55
Obituary—Mr. F. C. Henvey 58
The Classification of Ants, by R. C. Wroughton 78
Thana Forests and their Working Plans, by G. P. Millett 89
The advantage of preliminary practical work in the training of Indian Forest Officers, by J. S. Gamble 96
Forest Settlements in India, by B.H. Baden-Powell, C. I. E. 132
Famine Work in the Madras Forests ... 148
The Stinging Tree, by J. S. G. 148
Village Forests, by Tserofski 150
The Germination of Teak, by S. C. Moss ... 178
The Double Cocoanut of the Seychelles Islands, translated from the '*Révue Agricole*' of Mauritius, by A. S. ... 181
Cutch and its adulterants, by F. J. Branthwaite 184,217
Obituary, A. J. Mein and W. E. D'Arcy ... 185
The Forests of Natal; being an account of the Report on them by H. G. Fourcade of the Cape Forest Service, by D. E. Hutchins 205,245

Timber carting in Surrey, by A. W. Lushington 214
Rate of growth of teak in the Magayee Plantations, Burma, by J. N. 218
A note on the Californian Poison oak, translated by S. E-W. 222
Christen's Patent Dendrometer, translated from the *Forst-und Jagd Zeitung* ... 254
The Extermination of Wild beasts in the Central Provinces, by P. H. C. ... 255
Note on Turpentine, by E. Thurston ... 261
Teak cultivation, by W. Buurman (translated)... 285
Instruction in Forestry at Coopers Hill, by W. R. Fisher 292
Coorg and its timbers, by G. H. Foster ... 297,332
Useful Maxims for Tree-planting (translated) ... 303
The 'Local Trade' in Upper Burma, by J. N. 334
The qualities of good saws, by A. W. Lushington 337
Bürgermeister Krahe, by Sir D. Brandis, K. C. I. E., ... 340
Cast Wood (translated from the *Révue des Eaux et Forêts*) 341
Forest Administration in the Central Provinces, by 'Tuscan.' 373
Durability of Railway Sleepers, by A. S. ... 379
Forest and Revenue Officers 379
On Pruning—translation from the '*Révue des Eaux et Forêts*, by A. F. G. ... 383
The Andamans, by E. M. B 411
The condition of Forestry in New Zealand. ... 416
Tour of the Coopers Hill Students in France (Translation) 417
A great day at the Forest School at Nancy. ... 417
Grazing and commutation in the Central Provinces. 418
The Date Sugar Industry of Bengal, by Upendra Nath Kanjilal 451
Comparison between the Floras of the Eastern and Western Peninsulas of India, by Sir D. Brandis (translated by C. G. R.) 457
The Forest Service of Netherlands India ... 460
Visit of Spanish Foresters to the French Reboisement Works (from the *Révue des Eaux et Forêts*) 460

II.—CORRESPONDENCE.—

	Page.
A Hand seed-drill.	22
A Forest Department 'Blazer' ...	60, 186, 229, 306, 464
False quantities in botanical names ...	60
The Thana Working Plans.	61
The Coopers Hill Prospectus, ...	99
The Grass Farm at Allahabad	154
The formation of Dew	155, 226
Fires caused by Sparks ...	155, 186, 342
The Warrant of Precedence, ...	225
A plea for our feathered friends, ...	227
Range Officers in the Central Provinces, ...	263
The Mythology of Forest fires, ...	263
Occurrence of the Hamadryad in the North-West Himalaya	265
The seeding of bamboos.	304
Fires caused by bamboo friction, ...	305, 388, 462
Reproduction by extraction of stumps, ...	305
The appointment of Foresters, ...	307
Teak in Travancore, ...	385
Improvement in the Indian Raspberry by cultivation, ...	386
Note on the reproduction of Shisham, ...	387
Forest and other Civil Officers in Bombay ...	419
The Bombay Administrative Rules ...	423

III.—OFFICIAL PAPERS AND INTELLIGENCE.—

Bengal Arboriculture	23
Review of the Report of the Imperial Forest School for 1890-91	61
Articles on forest products for the Board of Trade Journal	63
Rules to regulate appointments and promotions in the Provincial Forest Service ...	101
Effects of the Cyclone of November 2nd 1891 on the forests of the Andamans ...	156
The Dehra Dún Forest School, Distribution of prizes and certificates	187
Forest products used in Soapmaking ...	189
The Forest Budget of 1892-93, extract from the Finance Minister's Statement ...	190
Budget Estimates of the Forest Dept. for 1891-92	191
Note on Lucerne cultivation, by J. Mollison ...	266
Wheat prospects in India for the year ...	269
Rules for the study of Forestry by Officers on furlough	310
Report on the physique of Junior Forest Officers	312
The New Edition of the Code	312

Report of the Board of Control of the Forest School, Dehra Dun 312
Fodder Reserves and Pastures 343
Sources of Rubber Supply 349
Good conduct badges 389
Budget Estimates of the Forest Department for 1892-93 390
Forest Fellows of Coopers Hill 424
Joining arrangements for Forest Officers on first arrival 424
The re-organization of the Provincial and subordinate services 435
Note on the Potato disease in the Poona District 465
Pass marks at the Forest School Entrance Examination 469
Travelling Allowance of Foresters 469

IV.—REVIEWS.—

The Government Horticultural Gardens at Lucknow, 1890-91. 24
The Agri-Horticultural Gardens, Lahore, 1890-91 25
The Nagpore Experimental Farm, 1890-91. ... 25
Arboriculture in the Hyderabad Assigned Districts, 1890-91. 26
The Departments of Land Records and Agriculture in Bengal and Assam, 1890-91 27
Potato Culture—Mr F. W. Seer's Manual ... 27
Annual Report of the Botanical and Afforestation Department in Hongkong for 1890... 64
Progress Report of Forest Administration in Jodhpur for 1890-91 65
Progress Report of Forest Conservancy in Ceylon for 1890 66
Indian Museum Notes Vol. II, parts 1 to 4 .. 67
Report on the Department of Land Records and Agriculture, Burma, for 1890-91 68
Report on the Canal Plantations, N.-W P., for 1890 69
Report on Forest Conservancy in Victoria in 1890. 109
Descriptive List of the Timber trees of the Central Provinces of Ceylon 113
Forest Work in Baluchistan in 1890-91 ... 114
The Central Provinces Forest Report for 1890-91 157
The Agricultural Bureau of South Australia ... 191
The Madras Forest Administration Report for 1890-91. ... . 192, 471
"Inventions" 195
Administration Report on the Railways in India, for 1890-91 230
Raising Strawberries from seed, ... 232
The Berar Forest Report of 1890-91 ... 232

Annual Forest Administration Reports of Bengal, Ajmere and the Andamans for 1890-91. 269
Annual Report of the Khandesh Experimental Farm for 1890-91. 272
The Scrub Exterminator 273
Annual Forest Administration Reports of the N.-W P. and Oudh and Coorg, for 1890-91 317
Number of species iu the Java Flora ... 320
Manilla Hemp 320
Report on Forest Administration in the Jeypore State for 1891. 354
Effect of the time of felling on the production and development of coppice shoots ... 355, 391
Indian Meteorology 359
Vegetable cultivation in India 361
Annual progress Report of State Forest Administration in New South Wales for 1890. 395
Peach culture in Simla District 401
Report on the operations of the Department of Land Records and Agriculture, Madras, for 1890-91 434
Administration Report of the Railways in India for 1891-92 435
Forestry in South Australia 436
Botanical and Afforestation Department of Hongkong in 1892 470

V.—SHIKAR.—

Another last tiger, by S. E-W. 70
Accident during the Garhwal Kheddas: The end of the rogue elephant 115
Destruction of a rogue elephant in the Dún, by Rajah Runbeer Singh 196
A tiger killed by buffaloes 198
A Man-eater, by E D. 234
The Dehra Dún Fishing Association 274
A trip to Bara Bangahal, by F. O. L. ... 321, 437
Camp incidents in N India, by O. C. ... 362
Hollow-fronted Bullets and large game, by O. C. 402
Forest School Sports, Dehra Dún ... 441
Extraordinary Capture of Wild Elephants, by H B. Bryant 472
Dehra Dún Camp of Exercise 473

VI.—EXTRACTS, NOTES, AND QUERIES.—

Diseases of Conifers 29
Saltness of Cocoanut milk in the Sunderbuns ... 30
Grass-farming at Allahabad. 31
A Cannibal plant 35
'Tombak' 38
Collecting Mosses 72
The Indian Forest Service and its founders ... 73
Casuarinas 76
Forest of Box 76
A curious find in a Walnut Tree ... 76
Utilization of cut Grass in Reserves ... 77
Elephant-catching operations 77
The Forests of India and their products ... 118
Kamila dye in Ganjam 122
Indian Gutta Percha 122
The new Professor of Forestry at Edinburgh ... 123
Change of Editorship of the *Révue des Eaux et Forêts* 123
The Forest Department List 123
Effects of parasites on trees 124
Portraits of Forest Officers for the Nancy Collection 159
The Economic importance of birds in India, by W. L. Sclater 160
A new method of sawing planks 164
Forestry in Ireland 164
Death of Mr. John Macgregor of Dunkeld ... 165
Padouk wood in England 166
Deterioration of Scotch Fir 166
The European C. S. Association 172
Growth of planted trees in Assam ... 198
Aloe fibre 199
Eucalyptus Oil 201
The Teak trade of the Laos States ... 203
The comparative value of various fuels ... 236
The pencil cedar industry 238
Creosoting sleepers 239
Is it good to dig about trees ? 240
Olive oil in the South of France 241
Forestry Lectures in Edinburgh University—*Session* 1891-92. 243
Seeding of Bamboos 244
The Oak 275
Goats in the Bombay Presidency 275
Match manufacture in Japan 276
The preservation of logs 277
The influence of Forests on Water-supply ... 277
Alaskan Forests 280
Report on the Timber trade of Bosnia and the Herzegovina 323

A Burmese Axe-head Wood 327
How nutmegs are grown 328
The new head of the Woods and Forests Department of the Cape 329
Dew, and its action on plants 364
Forest destruction and the Russian famine ... 366
Seeds of Sugar-maple 366
Match maunfacture in India ... 367
State Forestry in America 367
The largest band saw machine ever made ... 367
White Wax in China 468
The Coopers Hill Prize day 404
A serious grievance 405
Wattle bark for tanning 405
A Tea-Estate pest in the Dún 406
A corner in "Nuns." 407
State Forestry in America 407
The Brandis Prize 408
On Judicious Pruning... 443
The history of a Railway Sleeper 446
A new method of preserving potatoes ... 474
Barré and the discovery of the Coco-de-mer ... 474
Pruning in Parks and Gardens 477
New appointment of Col. Bailey, R. E. ... 479
Wood Concrete 480

VII.—Timber and Produce Trade.—

Churchill and Sim's Wood Circular 40, 79, 126, 172, 245 284, 371, 408, 449, 482
London Produce Sales 40, 173
Selling rates of timber in the N.-W. Provinces 125, 204, 330, 481
The Teak Market in the first quarter of 1892 282
Market rates for products ... 284, 331, 409, 450, 482

VIII.—Extracts from Official Gazettes.

Supplements.—

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(1) Padauk Wood.
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